NOVEMBER 1952

# PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

PMM

DESIGN • MANUFACTURE • FINISHING • USE

# VELVAGLAZE

another example of
MONARCH VELVAGLAZE
aluminum Permanent
Mold Castings

## FIRST...AN
## NOW...AN *INDUSTRY STANDARD*

**Seeking to add eye appeal to waffle bakers, a leading manufacturer found that Monarch Velvaglaze aluminum Permanent Molded grids improved product performance and sales. This special low-cost finish stays bright and velvety smooth... imparts a dense, durable surface that prevents sticking... needs no greasing. Today VELVAGLAZE is generally recognized by leading manufacturers as the ideal finish for waffle grids.**

**VELVAGLAZE is exclusively available on Monarch aluminum Permanent Mold and aluminum Diecastings. It is one of the complete range of finishing methods available on Monarch's castings. Why don't you investigate how VELVAGLAZE can improve product performance, reduce cost and add sales appeal.**

## *Write Today*

*for Monarch's two folders that help solve the problems of low-cost finish on high quality aluminum Permanent Mold and aluminum Diecastings.*

- *Aluminum Permanent Mold*
- *Aluminum Die Castings*
- *Certified Zinc Die Castings*
- *Complete Product Assembly*
- *Every Modern Finishing Service*

**Detroit Ave. at W. 93rd St., Cleveland 2, Ohio**


# CASTING NEWS NOTES

**A TREMENDOUS AMOUNT OF LITERATURE** has been released discussing tolerances, wall thicknesses and design characteristics which can be held in die castings and permanent mold castings. This material reflects itself in the casting designs we receive for quotation and ultimately becomes an important factor in your price analysis between competitive quotations.

* * *

**DESPITE CAREFUL PLANNING** and rigid controls, variations are bound to occur in castings formed from molten metal at 1200° to 1400° and poured or injected into dies or molds. Shrinkage of metal when solidifying and expansion and contraction of the mold or die are basic conditions influencing tolerances. Aluminum shrinks .013 per inch from a molten to a solid state and dies or molds expand at temperatures from 500° to 800° approximately .006 to .007 per inch. Casting dimensions are bound to vary slightly under these conditions.

* * *

**DIMENSIONS ALSO VARY** from parting lines on one die or mold half to any point on the opposite side of the die or mold. Multiple and compound parting lines as well as core pulls encountered on complicated casting designs will also reflect a variation in dimensions which must be analyzed against the tolerances allowed.

* * *

**THE DESIGN ENGINEER** should always carefully consider the draft requirements which must be allowed in the casting processes. Lack of proper draft affects the casting cycle, creates surface imperfections such as drags and cracks, and must be analyzed individually on each casting requirement.

* * *

**IT IS STANDARD PRACTICE AT MONARCH** to mark up a drawing to show any factors involved in our quotations which are not consistent with the original blue print design submitted to us. This analysis by our Engineering Department usually involves the factors discussed above. It is our means of showing what we consider to be the most practical design from point of manufacturing. In this manner we endeavor to show you exactly what we intend to produce, how it affects your end cost and not leave any hidden problems that could arise at a point when you require castings in production volume. We welcome the opportunity to have your design engineers discuss these factors with our Engineering Department for a clarification on the final design to apply. MONARCH ALUMINUM MFG. COMPANY, DETROIT AVENUE AT WEST 93rd STREET, CLEVELAND 2, OHIO.

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# Bring Yourself Up To Date!...

See what's been done to increase speed, accuracy and safety in machine die-casting. This new catalog introduces the latest models in Cast-Masters . . . Gives detailed illustrations and specifications . . . Tells about exclusive Cast-Master developments that are setting the pace for the industry. Send for your free copy now!

*CAST-MASTER DIE CASTING MACHINES, in the past Decade have proven themselves, in plants from Coast-to-Coast! For high-speed production, greater dependability, lower cost operation and longer life, you'll find CAST-MASTER has no peer!*

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Name_____

Title_____

Company_____

Address_____

City_____ State_____

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# METAL POWDER PARTS

## *by Moraine*

***Know-how*** **is the vital commodity in fast, economical, completely satisfactory production of parts from metal powder . . . and Moraine has the know-how that comes from more than a quarter of a century devoted to making billions of Durex metal powder parts.**

**Our experience, plus the knowledge we direct toward a continuous program of engineering research and production improvements, adds up to the know-how that can be of important service to many industries.**

**MORAINE PRODUCTS** DIVISION OF GENERAL MOTORS DAYTON, OHIO

NOVEMBER 1952
Vol. 10 No. 11

# PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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• Need die castings? Newton-New Haven has the facilities for the production of zinc and aluminum alloy die castings.
Place your die casting responsibilities with Newton-New Haven. Here is an organization that has the equipment, the personnel, the experience and the whole-hearted desire to help.
Newton-New Haven has prepared a booklet on "Dimensioning Die Castings." This is a basic data that every Engineer and Designer should have. Write on your company letterhead for your copy.
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THE NEWTON-NEW HAVEN COMPANY
WEST HAVEN 16
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# LETTERS TO THE EDITOR

**BRASS DIE CASTINGS**

It would be greatly appreciated if you could furnish the writer c/o our Chicago office a list of several companies that you might know that presently produce copper alloy (brass) die castings from permanent molds.

We manufacture plumbing fixtures and have our own brass foundry, but we are interested in having some items fabricated, using the above method.

—O. L. G.

*There are several companies specializing in this type of casting. List has been forwarded.* —*Ed.*

---

**FROZEN MERCURY CASTINGS**

I would like to have more information on the article "Investment Casting from Frozen Mercury Patterns" in the January 1952 issue, page 65.

1. What is the composition, method of use, source and price of the ceramic slurry used as the investment.

2. I would like to have a directory giving the same information on all investment materials on the market.

3. What is the address of the Mercast Corp. I want to know the terms of their license to use the process and what equipment and cost is involved. —A. H. B.

*Since the Mercast process is covered by a licensing arrangement, all specific details concerning the process will have to come from the licensor. Name and address have been forwarded. However, there are several companies whose specialty is the sale of investment casting materials, and from them can be compiled a "directory" of materials. We do not have on hand such a list at the present time. Names of suppliers of invest-*

continued on page 6

# Choose PRESSURE for your DIE CASTINGS

Why? One very good reason is Joe Obermayer, our chief engineer and a nationally recognized die casting authority.

For more than twenty years Joe and his staff of engineers at PRESSURE have been solving design problems and improving countless products, parts and methods.

The counsel and advice of these engineers, trained in the skills of die casting, are available to you at all times.

Send us your inquiries.

PRESSURE CASTINGS, INC.

*die castings*

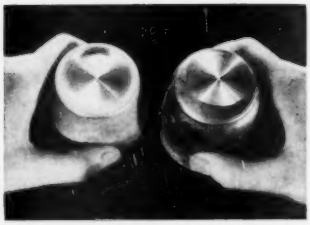
ZINC AND ALUMINUM ALLOYS

CLEVELAND 10, OHIO

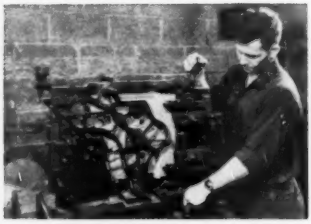
HOW DO YOUR CASTINGS RATE ON THIS

# Check List

FOR ALUMINUM CASTINGS?

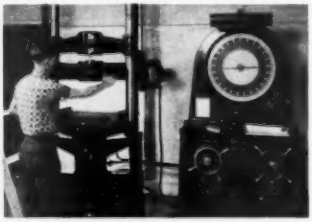


☑ **Freedom from Pinhole Porosity?**
Are sections of castings from each heat examined for pinhole porosity? That's the practice at Acme Aluminum Alloys where every heat must *prove* it has been properly degassed.



☑ **Close Dimensional Tolerances?**
Do your aluminum sand castings meet specifications for accuracy and freedom from external blemishes? Acme castings do . . . up to 1/64" accuracy on small sizes . . . up to 1/32" accuracy on large.

☑ **Freedom from Hidden Defects?**
Are you machining your aluminum castings as much as 75% complete only to discover hidden defects? Foundry practice at Acme uses X-ray to *prevent* defects, can be used for 100% X-ray.



☑ **Accurate Mechanical Properties?**
Are mechanical properties tested by test bar or a section from one of your castings? Using an actual casting produces more accurate results . . . is the method used by Acme.

A 6-point laboratory control system explains the outstanding quality of Acme aluminum castings. Moisture analysis of foundry sand . . . porosity analysis of each melt prior to pouring . . . analytical control by spectroscope . . . mechanical control by test castings . . . heat treat control to ± 5° F. by automatic equipment . . . hidden defects revealed by X-ray examination: this is the way Acme guards casting quality. *Are you getting top quality aluminum castings?*

Foundry Division

Acme

**ALUMINUM ALLOYS, INC.**
**17 N. Findlay St., Dayton 3, Ohio**

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Please send me your latest bulletin, without obligation on my part.

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LETTERS TO THE EDITOR
continued from page 4

## FAVORS ORGANIZATION OF INVESTMENT CASTERS

It is my desire to bring to the attention of the investment casting industry the need for an association or institute to perform certain functions which would be beneficial to all members of the industry. I am using the mailing facilities of Precision Metal Molding magazine to convey this message to the industry.

There are several reasons why an organization is urgently needed and I will list some of those which are most apparent.

1. The investment casting of metals for industry is comparatively new and there is a need for an educational program directed to the buyers and engineers of industrial plants. An organization could function as a source of this educational program much more economically than individual companies and a committee of members would have a much larger and more accurate fund of information at it's disposal than any one company.

2. For the same reason, that the industry is new, there are always new problems coming up in production and an association could act as a clearing house for technical information for its members which would save each member hundreds of dollars in costly experimental work.

3. Standardization of manufacturing policies and also methods of submitting quotations. At present there is such a variance between different companies that it is impossible for the buyers to make accurate comparisons and this tends to create a lack of confidence in the industry as a whole. At the present time there seems to be a great need to inspire confidence in the mind of the buyer and the

engineer that the investment casting industry is well founded and has the know how and the facilities for producing satisfactory parts to meet his requirements.

The investment casting has a definite place in industrial production and it's future is as bright as any one could hope for . I do believe, however, that it's future success can best be achieved through cooperative effort and this cooperation can best be obtained through the formation of an association of investment casting companies.

This letter is written to solicit your opinions and your desire to have an association.—Robert Warrington, Engineer, The Adapti Company, Cleveland, Ohio.

*Comments on Mr. Warrington's suggestion for the formation of an investment casting organization will be welcomed by the editors of PMM who will turn over all response to Mr. Warrington.—Ed.*

---

**SMALL DIE CASTINGS IN ZINC ALLOY**

Please send me information on using zinc for die-casting small parts, and the common alloys and grades available, with properties of each.—J.H.M.

*There are several companies who specialize in the production of small die castings. Names of these have been forwarded. Each of them has available some literature on the alloys, physical properties and design data which will be useful in planning your small die castings.*

*Small zinc die castings have some outstanding advantages over comparable parts fabricated from screw machine parts and stampings, especially in cost. However, the one-piece die casting often is superior in rigidity and strength because small brazed, pinned or soldered assemblies are frequently difficult to unite into a secure assembly.—Ed.*


DEPENDABLE
BETTER METHODS
SUPER CAST
DIE CASTINGS
BETTER DIE CASTINGS
SINCE 1919

***The meaning of a signature!***

Through a quarter of a century of knowing how, the SUPER CAST reputation for Better Methods—Better Die Castings, has been recognized.

Sound engineering, metallurgical knowledge and skilled techniques have achieved and maintained a standard of superior quality.

SUPER CAST has kept faith, always deserving the mark it bears. SUPER CAST means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

**THE SUPERIOR DIE CASTING COMPANY**
1001 London Road CLEVELAND 10, OHIO

*For additional information Circle No. 24 on the Reader Service Card*

1 **DIE CASTING** is the Process...

number 2 of a series **ZINC,** the Metal...

3 **BUNKER HILL,** the *Preferred* Zinc

**ZINC ALLOYS** are used to the extent of approximately 60% by weight of all die cast parts consumed annually in the United States, largely because of economies resulting from the ease and speed with which they can be cast. The low casting temperature (750 to 800°F) of these alloys results in low fuel cost, low die cost, and low die maintenance. The castings are dimensionally stable, have excellent mechanical properties and can be economically polished, plated, painted, or finished by other processes. Zinc alloys also have high fluidity at casting temperatures. Die castings of highly complex design needing little or no machining can thus be readily produced.

The ability to cast zinc alloys of remarkable smoothness keeps finishing requirements to a minimum. Frequently, only buffing is necessary prior to plating in brass, nickel or chromium, or for the application of other types of finishes. This is a primary reason for using zinc base die castings almost exclusively for hardware and decorative applications, especially in automobiles and countless other consumer products. The production of the most intricate zinc alloy castings has become an everyday job.

Today, die castings based on zinc are a vital factor in modern engineering processing, and their range of applications is constantly being broadened as industry comes to appreciate the advantages and the extent of the economies that zinc base die castings yield.

Eastern Sales Agents: **ST. JOSEPH LEAD CO., 250 PARK AVE., NEW YORK 17**

# BUNKER HILL 99.99+% ZINC

Sales Office for Pacific Coast: **NORTHWEST LEAD CO., SEATTLE, WASH.**

## Between The Lines
### in this and coming issues of PMM

• PHYSICAL AND MECHANICAL properties of investment cast test specimens is a significant part of the article on the use of investment castings for aircraft structural parts beginning on page 34 of this issue. Physicals differ from those of wrought material having same composition.

• INERTIA is always a prime consideration in rotating members such as the drum of a duplicating machine. The way Standard Duplicating Machine Company has met this problem with zinc die castings is related beginning on page 30.

• PROTECTION OF CHROMIUM plating by means of clear organic coatings is given attention in this month's PMM Finishing Section. Few subjects are more important to the manufacturer and user of plated zinc die castings nowadays.

• FROZEN MERCURY patterns for investment casting have prompted so many inquiries that PMM is offering a photo story on the Mercast process which employs this type of pattern, beginning on page 24.

• SIMPLIFIED SOLUTIONS for Production Problems is a special department each month. You'll find it on pages 65 and 66 this month.

• WATCH FOR an article on electroforming as a production method in PMM. You will find ideas for putting this precision process to work on parts having difficult internal shapes and dimensions to hold.

• THE AUTO INDUSTRY is using more zinc die castings in 1953 models. Many are replacing stampings. PMM will bring you the whole picture of this major development.


Here's how 13 Twin City Castings prove LUCKY in this SCOTCH BRAND Tape dispenser

13 TWIN CITY CASTINGS USED IN TYPE "M" BOX SEALER

Here was a job that called for *more* than accurate dies and close-tolerance castings. It called for *co-operation* between designer and die caster . . . the kind of cooperation so important to creative manufacture.

Result: an extremely successful manually operated box sealer for use with Scotch brand cellophane tape. The unit is built by Specialty Manufacturing Company for Minnesota Mining and Manufacturing Co., manufacturers of Scotch tape. The dispenser contains 13 zinc die castings from complex main frame to small trip-pin arm . . . all *Twin City* die castings and *Twin City*-built dies.

If you have a particular die casting job, large or small, that calls for "cooperation" with your die caster . . . contact Twin City. Hundreds of manufacturers have found that it pays.

TWIN CITY DIE CASTINGS CO.
3350 TALMAGE AVENUE S. E. • MINNEAPOLIS 14, MINN.

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for Quality Production

AMERICAN ELECTROLYTIC

# 99.99+% SLAB ZINC

A reliable source for die casting requirements

**AMERICAN ZINC SALES COMPANY**

Distributors for

**American Zinc, Lead & Smelting Company**

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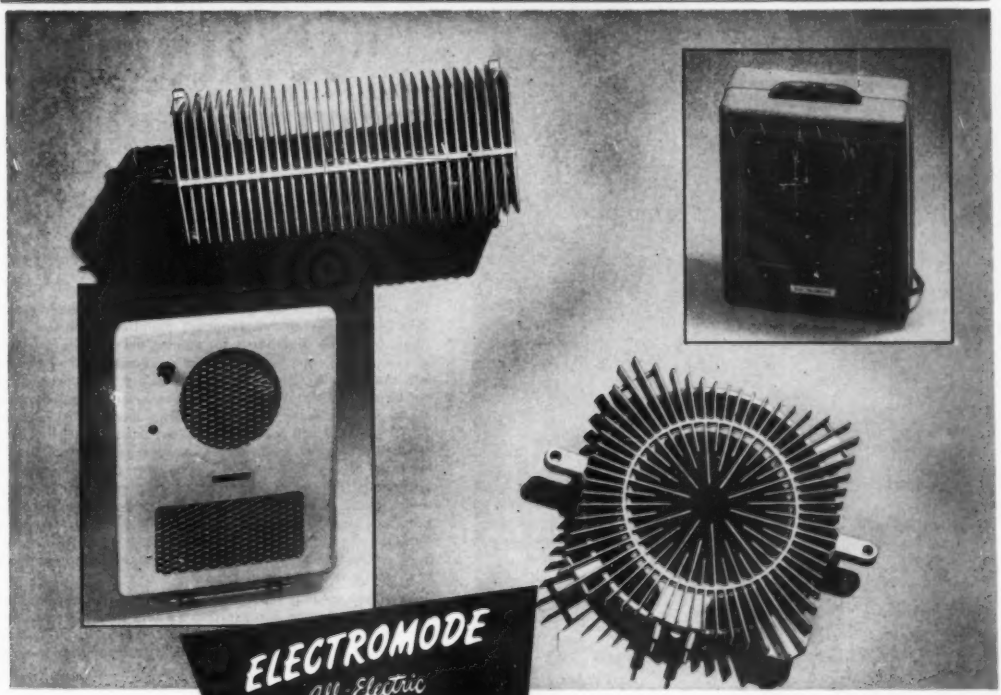
# No Problem's Too Tough *when you call in* ... PRECISION




**PRECISION Casts These Elements For –**

The Electromode patented die cast aluminum Safety-Grid heating element, illustrated above, consists of a nickel chromium resistor wire, insulated with a fused oxide powder, encased in a seamless metal sheath, and die cast in the finned aluminum casting, which completely seals the element.

Because of the high thermal conductivity of aluminum and the finned shape of the casting, the Safety-Grid dissipates heat rapidly, but stays at a relatively low operating temperature. Practically impervious to corrosion and oxidation, it will far outlast ordinary open wire elements.

In producing these aluminum die castings, Precision demonstrated these abilities:

- Superior casting techniques made possible the production of castings requiring highly complicated coring methods.
- Production of die castings with multiple thin sections.
- Assurance of an unfailing supply of die castings to the customer.

*Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry.*

**PRECISION CASTINGS CO., Inc.**
212 Walnut St., Fayetteville, N. Y.
Syracuse, N. Y. · Cleveland, O. · Kalamazoo, Mich. · Chicago, Ill.
British Affiliation — Wolverhampton Die Casting Co. Wolverhampton, England

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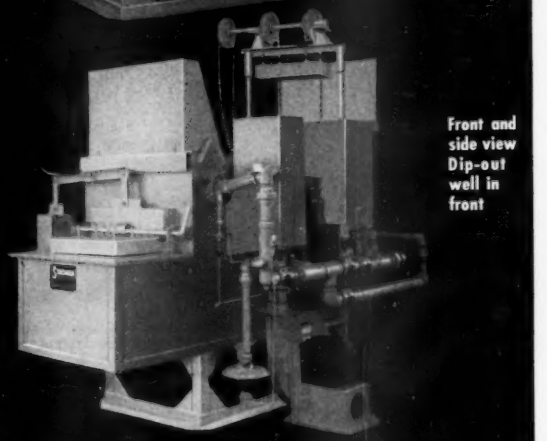
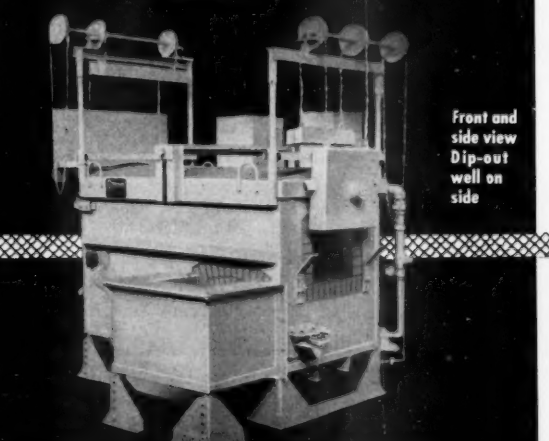
# Look! It's Our Baby!

Rear and side view Showing Charging Door



Front and side view Dip-out well in front



Front and side view Dip-out well on side

# NEW STROMAN DOUBLE CHAMBER "DC" ALUMINUM MELTING FURNACE

## For Die Casting • Sand Casting or Permanent Mold Plants

This revolutionary type furnace for melting and holding aluminum is composed of two separate chambers combined into a single unit. One chamber is for melting only, where the ingots or returns are completely covered by flame as they are fed into the charging door and all capilatory moisture is driven out before the metal melts and runs into the holding chamber. Metal usually flows into the holding chamber at between 1160—1180 degrees. Cold, or moist metal NEVER reaches the molten bath. This eliminates gas pick-up and the resultant fault . . . porosity. The holding chamber is heated separately from the melting chamber to assure correct pouring temperature. Both chambers have automatic temperature controls, to eliminate manual miscalculations. Metal in the holding chamber can be controlled to within plus or minus 10 degrees, as it is constantly fed from the melting chamber with metal of a constant temperature.

Another outstanding feature is that it eliminates hard spots in the molten bath, and the bath can be held day in and day out without tapping, and show no ill effects. With a "DC" Aluminum Furnace you can do away with the tasks of tapping and making ingots at night and time wasting heating-up in the morning. Fuel costs for keeping metal at correct temperature overnight are negligible in comparison to time wasted in the old way. Man hours are costly and hard to find . . . conserve them!

An exclusive feature that die casters and permanent mold founders will find a great convenience and economy is the fact that REJECTED CASTINGS CONTAINING INSERTS can be remelted in the "DC". It sweats the aluminum off the insert in the melting chamber and leaves the insert where it can easily be raked out of the charging door.

Separate melting and holding in one unit also keeps fuel costs at an astounding low . . . as metal does not lose temperature in transport from melting to holding furnaces and there is no preheating of holding crucibles. With a "DC" constant, efficient, flawless and most economical castings are assured.

Capacities range from 700 pounds a molten bath up. Gas, Oil, or Combination Gas-Oil Fire.

***WRITE TODAY FOR:***
***Specifications . . . Aluminum Heat Content Chart***
***Section View of Stroman "DC" Furnaces***

**STROMAN**

**FURNACE & ENGINEERING CO.**

Division of The Petersen Oven Co.
9900 Franklin Ave., Franklin Park, Illinois

*For additional information Circle No. 13 on the Reader Service Card*

aircraft component steel parts made from

ACCUMET
PRECISION
INVESTMENT CASTINGS

The pictured castings are currently being used to produce such important aircraft accessories as fuel injectors and regulators, carburetors, landing gear door latch mechanisms, rocket release mechanisms and radar equipment. Cast to close tolerances with smooth surface finish, expensive machining operations are avoided—resulting in saving of valuable time, reduction in cost and eliminating the need for hard-to-get machine tools. Also *Accumet Precision Investment Castings* permit the use of higher alloyed steels that are difficult or impossible to machine or forge, thus increasing the life or performance of the component parts.

**ENGINEERING SERVICE AVAILABLE**

*Crucible* engineers and metallurgists are available to assist you in solving your design or production problems by the application of these Accumet Precision Investment Castings . . . that are playing such an important part in our National Defense Program.

**CRUCIBLE**

first name in special purpose steels

*52 years of Fine steelmaking*

**ACCUMET PRECISION CASTINGS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

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# AJAXOMATIC

AN AUTOMATIC POURING UNIT FOR THE PRODUCTION OF ALUMINUM DIE CASTINGS

**It pours molten aluminum in a gentle, controlled wide stream.**

***Write for descriptive folder A-3***

## AJAX ENGINEERING CORPORATION

TRENTON, N. J.

VELVAGLAZE

MONARCH VELVAGLAZED DIE CASTINGS USED ON THE GENERAL ELECTRIC CANNISTER CLEANER

Cuts Finishing Costs...

AND IMPROVES PRODUCT QUALITY

Velvaglaze is now used by leading manufacturers to obtain a more durable, brighter surface finish that improves product sales appeal. Velvaglaze resists scratching and marring experienced on normal cast aluminum surfaces.

Velvaglaze is available exclusively on Monarch aluminum Permanent Mold castings and aluminum Die Castings. Investigate the substantial savings you can obtain over other comparable fine finishing methods using Monarch Velvaglaze castings.

WRITE TODAY FOR FREE BROCHURE

"Here's How You Can Cut Die Casting Finishing Costs"

Monarch ALUMINUM MFG. COMPANY

- Aluminum Permanent Mold
- Aluminum Die Castings
- Certified Zinc Die Castings
- Complete Product Assembly
- Every Modern Finishing Service

Detroit Ave. at W. 93rd St., Cleveland 2, Ohio

# CASTING NEWS NOTES

**THE INCREASING TREND** among American manufacturers to utilize the advantages and cost savings offered by Aluminum Permanent Mold castings and Aluminum Diecastings is emphasized by Department of Commerce monthly figures.

* * *

**PERMANENT MOLD AND DIECASTINGS** account for 60% of the current monthly shipments of all types of aluminum base castings with the tonnage between Permanent Mold and Diecastings running almost even. Unfilled orders, reported as of May 1952, indicate that this trend will continue in the months ahead.

* * *

**MONARCH'S UNIQUE POSITION** in both the Aluminum Permanent Mold and Diecasting field has a direct influence on these figures. We welcome an opportunity to clearly outline — without prejudice — the advantages that each of these modern production casting methods offer as an answer to your immediate casting problem.

* * *

The final choice between Permanent Mold and Diecasting methods of production should be based upon careful analysis of the following important factors:

**COST** — the final assembly cost of the casting with all variables considered.

**TOLERANCES** — factual evidence that casting tolerances can be maintained under full production conditions.

**PHYSICAL STRENGTH** — determine that required physical strength can be actually checked in production. Don't rely on "book values".

**SURFACE FINISH** — demand production evidence of surface quality required.

**PRODUCTION QUANTITIES** — analyze equipment capacity and flexibility of production method and source.

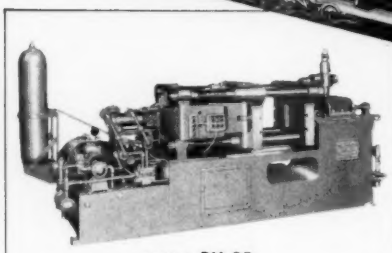
* * *

These are the factors that Monarch projects into every estimate that we formulate. We will endeavor to discuss each factor in greater detail in future columns. In the meantime, our experienced personnel are at your service to assist you in finding the correct answers to your casting problem. MONARCH ALUMINUM MFG. COMPANY, DETROIT AVENUE AT WEST 93rd STREET, CLEVELAND 2, OHIO.

# KUX

## FIRST NAME IN DIE CASTING MACHINES

### HELPS MAKE HUBLEY
### FIRST NAME IN ACTION TOYS



MODEL BH-30
Hydraulically operated die casting machine for production of zinc castings weighing up to 10 pounds.

THE TEXAN

Boys hate to be called, "sissy". To prove they're not, they go to great lengths to be rough and tough. That means their toys, too, have to be rough and tough. Hubley Manufacturing Company, by using KUX die casting machines in the manufacture of its "Texan" Repeater Pistol, gets that extra ruggedness necessary in producing toys that last.

WHAT ABOUT YOUR PRODUCT? Does it stand up to the treatment it has to take? KUX die casting machines can tremendously improve its quality and saleability. Call KUX now! Let us show you how!

**KUX** MACHINE COMPANY • 6725 N. Ridge, Chicago 26, Illinois

# KUX

## FIRST NAME IN DIE CASTING MACHINES
## SELECTED BY FIRST NAMES IN INDUSTRY

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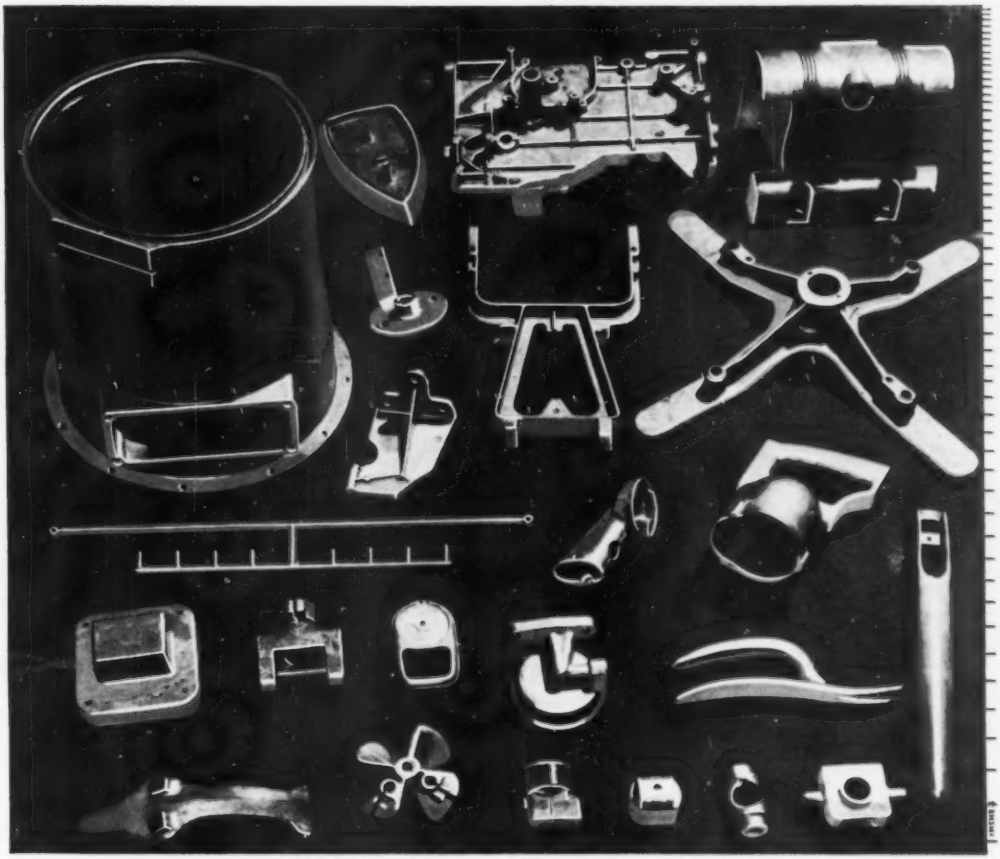
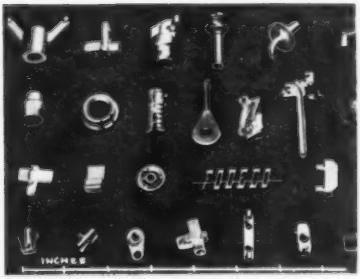


A few Dollin Zinc and Aluminum Die-Castings used in civilian products

# Zinc and Aluminum Die-Castings
## *in All Commercial Sizes for War or Peace*



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● A real cost-cutter! Specialized *automatic* equipment produces small castings at *high speed*. Check with us on consolidating two or more parts—or on cutting piece-costs of present parts requirements. Approximate size range: 1000 per lb. to 3 per lb. Send prints for quotation, or write for Small Parts Bulletin and samples.

***What is your problem?*** Have a government contract for equipment that incorporates—or *might* incorporate—a die-casting? Planning a civilian product with die-cast parts? For dependable service on *recognized* die-casting applications—or expert advice on *possible* applications—check with Dollin. You can depend on our long experience and extensive modern facilities for uniformly excellent results at low cost.

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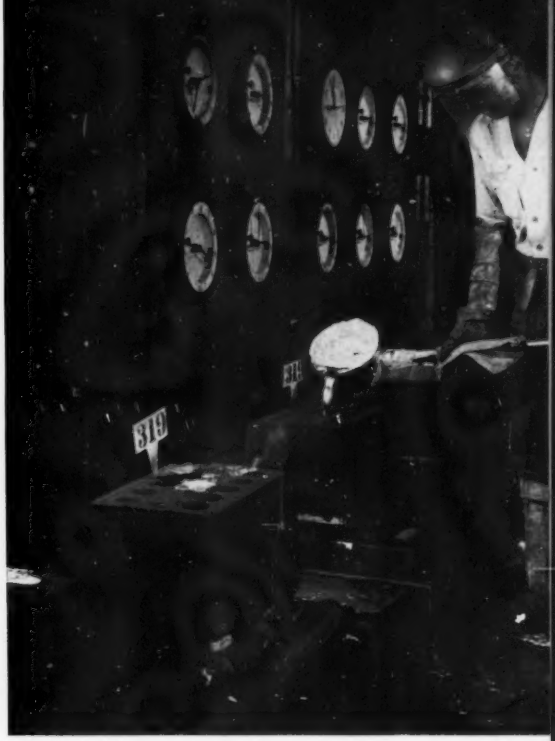
PLASTER CASTING

SAND CASTING



# ALCOA MAKES LIGHT METAL CASTINGS BY ALL FOUR PROCESSES

When you discuss your casting job with an Alcoa sales engineer, you can be sure that he will recommend the process that best fits your needs. If your part should be die cast, two modern die casting plants and 30 years' die casting experience back his recommendations. He can also suggest sand casting, for Alcoa has five sand foundries and 41 years' experience in the casting business. Permanent mold castings? Four of our foundries make permanent mold castings. One in Detroit specializes in plaster casting. Obviously, Alcoa sales engineers have no axe to grind for any one process.

The same applies to choice of light metals. Alcoa's casting facilities are equipped to handle both aluminum and magnesium. Alcoa casting specialists are old hands at working with light metals. Alcoa engineers are completely unbiased in their approach to any question you might put to them. For these reasons, Alcoa sales engineers are quick to point out the advantages of both aluminum and magnesium for your application.

Your first step toward using these extensive facilities is to call your local Alcoa sales office—listed under "Aluminum" in the classified phone book. Or write:

**ALUMINUM COMPANY OF AMERICA**
**1908-L Gulf Building • Pittsburgh 19, Pa.**

ALCOA ALUMINUM ®

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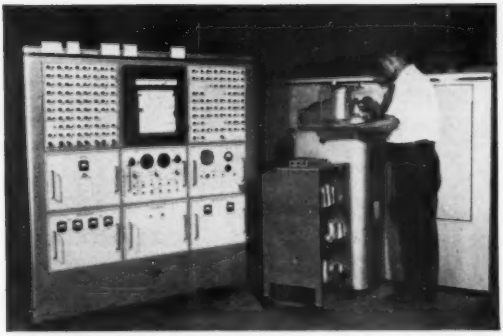
PERMANENT MOLD CASTING

DIE CASTING

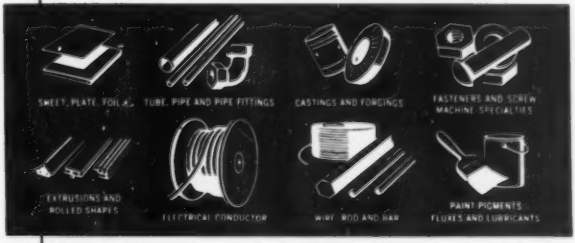


**ALLOY CONTROL**—Alcoa foundries are equipped with direct reading quantometers, like this. In less than a minute, these instruments provide a complete spectrographic analysis of an alloy being cast.

**RESEARCH TEST**—In Alcoa's 70,000 rpm whirlpit, rotating parts can be tested to destruction. Provision is also made for brittle lacquer and strain gage investigation while the rotating part is under stress.

**ASK ALCOA FIRST**
**WHATEVER YOUR NEED IN ALUMINUM**

Your local Alcoa sales office is headquarters for "everything" in aluminum. Look for Alcoa under "Aluminum" in your classified phone book.


SHEET, PLATE, FOIL &c.
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# USCO K

USCO K Aluminum Alloy is one of several standard die-casting alloys of the AXS-679 Revision 3 type. USCO K and the other aluminum alloys in the K series are production controlled from raw materials to finished ingot under the most modern methods of alloying and refining—giving you the uniform mechanical and physical properties you desire in your castings. If you prefer, we can produce an aluminum die-casting alloy to your exact specifications.

The specifications on AXS-679 Revision 3 are broad. In USCO K the Si is kept at the maximum limit to insure fluidity. The detrimental elements—Mg, Fe, Ni and Cr—are kept at the low limit to combat die-cast sludge. Even the unspecified elements—Pb and Na—are kept at a trace to prevent soldering.

Our metallurgical engineers, who have a practical working knowledge of your problems, are at your service always.

For outstanding castability—maximum production economy—uniformity of analysis and performance—order USCO K!

***FREE***—Send for your copy of the USCO Aluminum Alloy Selector. A handy aid to analysis, specifications and many other foundry problems.

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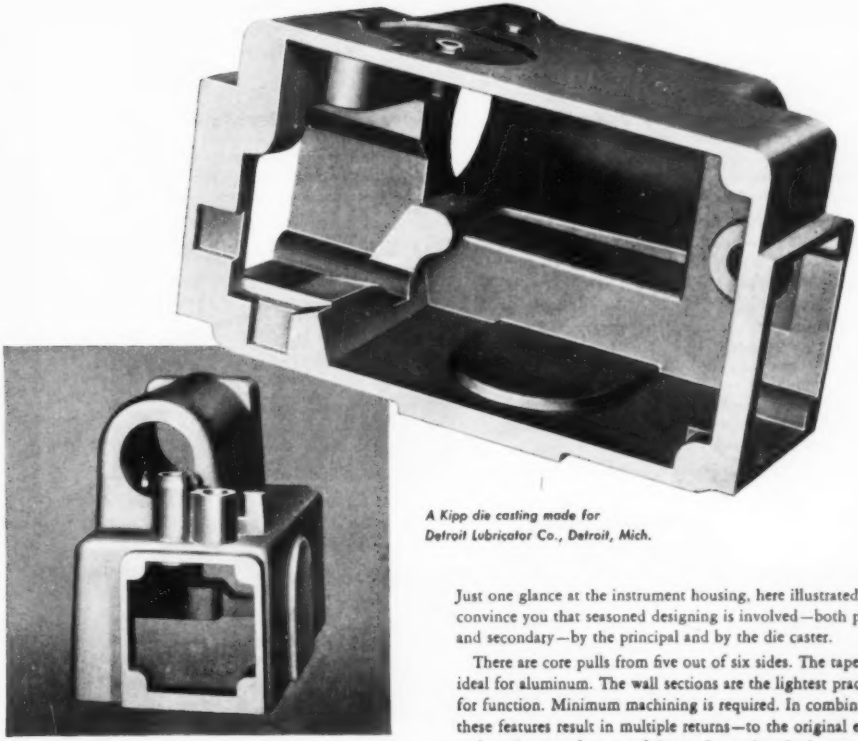
# DESIGNING
## for multiple profits with
# MADISON-KIPP
## ZINC AND ALUMINUM DIE CASTINGS



*A Kipp die casting made for Detroit Lubricator Co., Detroit, Mich.*

Just one glance at the instrument housing, here illustrated, will convince you that seasoned designing is involved—both primary and secondary—by the principal and by the die caster.

There are core pulls from five out of six sides. The tapers are ideal for aluminum. The wall sections are the lightest practicable for function. Minimum machining is required. In combination these features result in multiple returns—to the original equipment maker, the manufacturer of the product using the instrument and the ultimate user.

You can believe such established proofs and you can probably apply Madison-Kipp die castings to advantage in your new parts or those you expect to redesign. Please send your inquiries to our home office in Madison, Wisconsin.

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**MADISON-KIPP CORPORATION**
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● Skilled in Die Casting Mechanics ● Experienced in Lubrication Engineering ● Originators of Really High Speed Air Tools

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# DIE CASTING
## means strong lightweight assemblies at minimum cost

2000 impacts per minute. Does the work of hand wrenches; drills and taps.

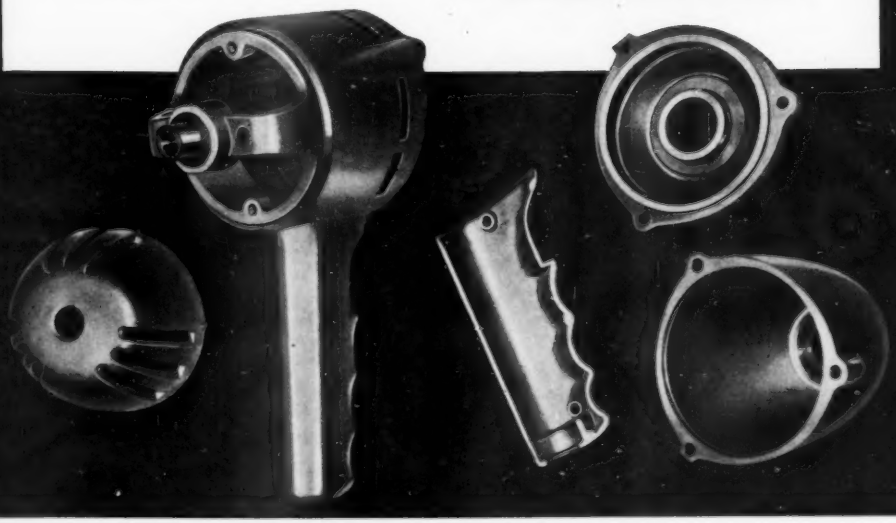
CASE HISTORIES FROM MT. VERNON FILES

If you use metal parts in appreciable quantities, die casting merits your careful consideration. For die casting not only simplifies and speeds production, but assures strong, lightweight, quality products at *minimum* cost.

These outstanding advantages are gained by the experienced Millers Falls Company, makers of tools since 1868, who specify die casting for the housing of their No. 555 Impact Tool.

The four parts of this housing, plus trigger and hand-grip, are produced quickly and economically by Mount Vernon. Cast from aluminum, complete with bronze bushings and other structural details as specified, these parts fit accurately together with minimum machining. Result: A lightweight, strong, good looking assembly *produced inexpensively.*

When next you have to decide upon a manufacturing procedure, focus on Mount Vernon die casting — and send us your specifications. We'll be glad to put our wealth of experience at your disposal, and show you the way to lower unit costs, increased output, improved products.





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# Weak, assembled components replaced by one-piece DIE CASTINGS

By. G. L. OMAN*

A change in manufacturing methods can only be justified if the end product is either less costly, functionally improved, or eliminates the need of purchasing costly machine tools. Any one of these is adequate reason to change, but when two or all three are involved, there can be no question about making the conversion. A case in point is found in some of the component parts of the breakaway coupling made by the J. I. Case Co. of Racine, Wisc. A section of one of these coupling is shown, Figure 1.

When the coupling was first designed, the male coupling sleeve and the female coupling piston were made by assembling a plurality of screw machine parts. Successful functioning of the coupling required that the orifices in both halves be of equal volume to minimize pressure drop across the coupling. To achieve this under conditions of variable pressure, one member was designed as a sleeve which was movable on a fixed rod. Due to differential spring pressures, this movable sleeve could shift its position as the oil pressure varied, thus giving greater or lesser openings as demanded.

To function smoothly and easily, the bore of the sleeve had to be held to rather close tolerances and the surface finish required was better than is normally secured by standard shop practice. When this sleeve was studied in an attempt to lower manufacturing costs, it became apparent that the two component parts could be fabricated as a single die casting. Such a single part would permit re-

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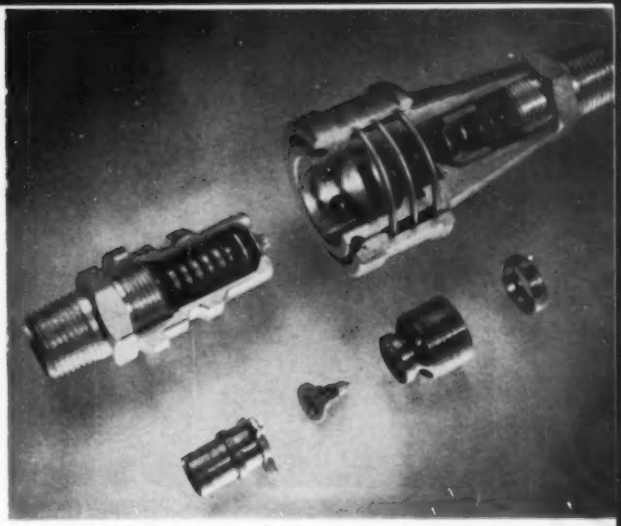
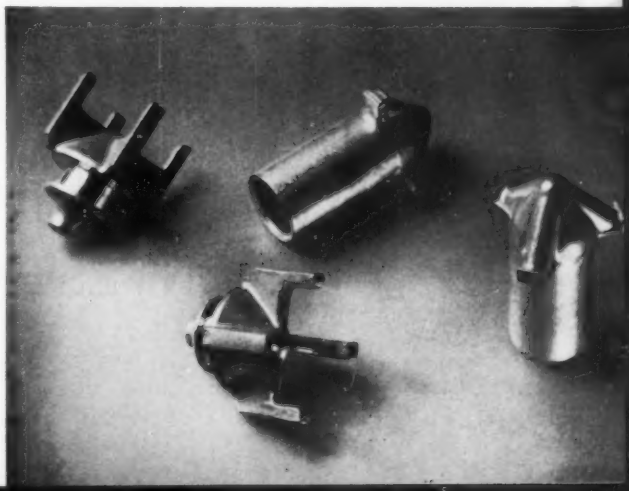
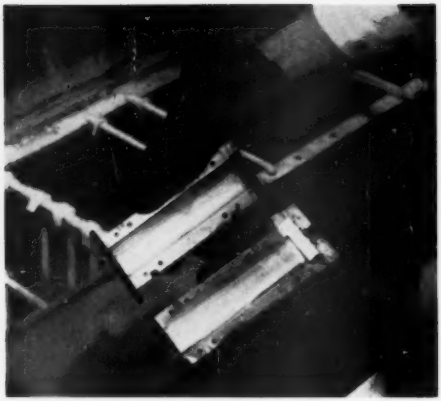


**1.** TWO SCREW MACHINE parts assembled into the sleeve, left foreground, and three other screw machine parts for the piston, right foreground, have been replaced by a pair of die castings.

**2.** LOWER COST is an extra advantage, along with superior performance characteristics, obtained from die cast piston, left, and die cast sleeve, right.



*Assistant Chief Engineer, Tractor Works J. I. Case Company.



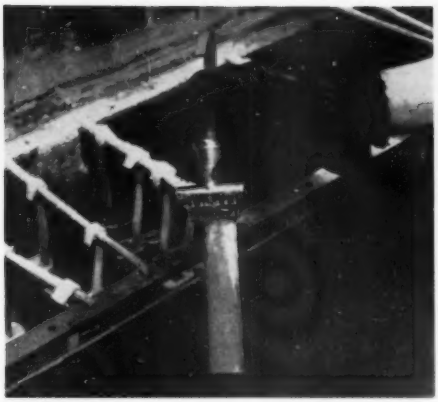
1. MOLD of hardened steel is carefully machined to be an exact negative of the finished part. Final accuracy and surface finish are determined here. Provision for a sprue and riser are incorporated in the mold.

2. LIQUID MERCURY, at room temperature, is poured into the closed mold. The favorable wetting characteristics of mercury on steel insures complete filling of the mold cavity. All air bubbles must be eliminated at this stage.

INVESTMENT CASTINGS produced by the Mercast process (using frozen mercury patterns) are distinguished by the excellent quality of surface finish and high degree of accuracy obtained. Mercastings are characterized by intricate shapes and "impossible" cores and/or undercuts . . . impossible, that is, by any other process maintaining the same finish and dimensional requirements.

Believing that design engineers who are familiar with the methods by which their components are produced can do a more effective job of designing, the editors of PMM present here a pictorial report of the steps in producing an investment casting by the Mercast process. All photos were taken at the Cleveland plant of Alloy Precision Castings Co. who specialize in this casting technique.

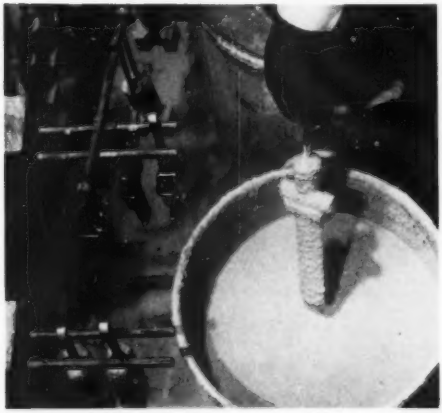
# How frozen mercury patterns are used to produce INVESTMENT CASTINGS



3. AFTER FREEZING the mercury by immersing the mold and its contents in dry ice and acetone the mold is removed. The pattern reproduces every detail of the mold. From now on, until investing is completed the mercury must be kept frozen.

4. FIRST INVESTMENT is a suspension of finely divided refractory material in a solvent that will evaporate at the temperature of the frozen mercury. This refractory must be fine enough to reproduce every feature of the mercury pattern.

5. SECOND INVESTMENT material coated on by successive dip coats. This refractory (the same as first used) is much coarser than before. Successive coats are applied until a layer about one-quarter inch thick is built up.



6. MELTING OUT the mercury pattern is accomplished by directing a stream of mercury at room temperature against the frozen pattern. This starts the melting, after the start, the process is self-perpetuating. All of the mercury is recovered and re-used.

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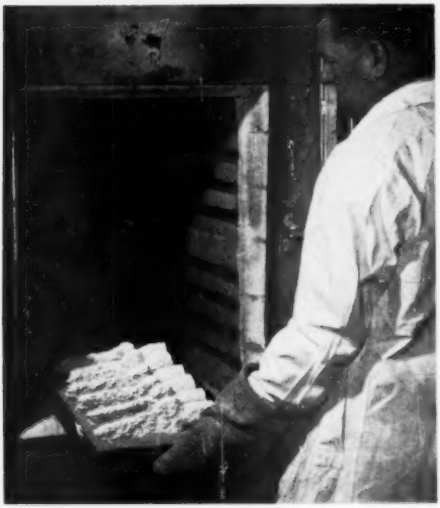
# INVESTMENT CASTINGS from mercury patterns--cont.

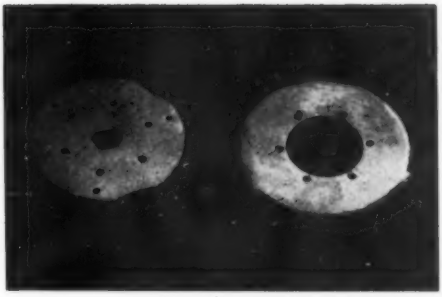


7. IN SPITE of its high density which effectively drains the cavity, some mercury may remain in the mold. This mercury will be evolved along with the binders in the green ceramic because at this point the molds are then fired at high temperatures (up to 1800F) which cures the mold. The result is a smooth, gas-free metal casting.

8. THE REFRACTORY MOLD is rather fragile. Before pouring the metal the mold must, therefore, be backed up with sand, shot, or some similar material. In addition to giving physical support the back-up material serves to reduce the rate of cooling of the metal.

9. THE CASTING METAL is melted in small batches, often in induction furnaces. Careful control of temperature and composition is imperative at this stage. Accuracy of the final casting will depend upon pouring temperature and cooling rate.

10. AFTER COOLING the final casting is removed from the backing material and the investment broken away. The casting after cutting off the gate and riser is, very often, ready for immediate use. In some cases minor machining such as tapping or light milling may be needed.



**1. FAR GREATER PRECISION than is normal for parts made by powder metallurgy is found in both of these gear box end plates. Only parts that can stand a higher than ordinary cost can be held to the tolerances specified.**

# Bearing plates for gear train redesigned from forgings to SINTERINGS*

MUCH of the written material concerning powder metallurgy has dealt, in part at least, with the precision of dimensions that can be held by the process. Actually, however, precision is a highly relative term varying from industry to industry and from part to part. Acceptable dimensional accuracy of a green sand casting would not be tolerated in a sintering* which, in turn, might be grossly inaccurate when compared with fine machine work. A part, therefore, made as a sintering from iron powder which in some of its dimensional tolerances equals fine machine work is exceptional; two such parts are shown in Figure 1.

The two sinterings* shown are the upper and lower bearing plates for a gear train used in a timing device. The original design of the pieces called for brass forgings which, of course, required machining all over. Since the diameter of and the center to center distance of the small holes are both highly critical dimensions, drilling had to be done on a jig-borer to maintain tolerances. Rejects were high and the finished cost of the bearing plates excessive.

Originally all of the small holes were backed-up with bosses 0.0468 thick. The holes were 0.078 deep and were blind so as to allow end bearing and to provide oil wells. Redesign for a sintering removed these bosses and made all of the holes through ones. As now being made by the Chicago Powdered Metal Products of Chicago, Ill. one of the bearing plates is shown in Figure 2.

The most notable feature of these sinterings is the close dimensional tolerances being held by the fabricator. From Figure 2 it can be seen that hole diameters and center to center distances as well as thickness of the plates are maintained with a total variation of only 0.0002. This accuracy is good

continued on page 67

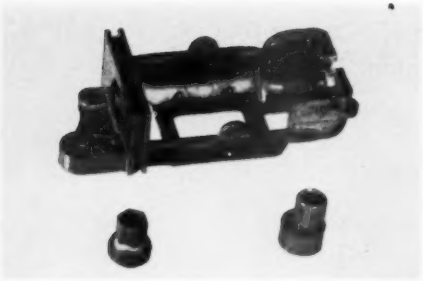
***SINTERINGS — New nomenclature for powdered metal parts**

**In describing parts made by powder metallurgical processes, a number of phrases have been used, such as "powdered metal parts." Not only is such a phrase clumsy, but it carries with it a connotation that is both inaccurate and undesirable.**

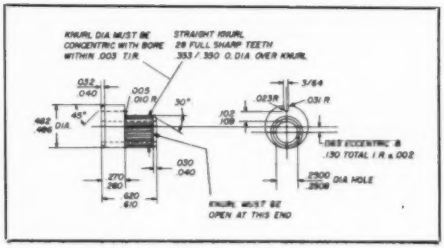
**At the suggestion of the nomenclature sub-committee of the committee B-9 of American Society for Testing Materials, PRECISION METAL MOLDING magazine will utilize the noun, "sintering" in place of the clumsy phrase.**

**As an example, instead of writing, "The clutch plate is a powdered metal part made from bronze powder," the staff of PMM will write, "The clutch plate is a bronze sintering."**

**Hoping that this term will help to standardize and clarify nomenclature, the editors of PMM invite comments and suggestions from our readers.**



**1. SINTERINGS AND A DIE CASTING combine to form a trouble-free, rigid unit for the professional hairclipper so that the plastic case need have no mechanical function other than to furnish a slip-proof insulating hand piece.**




**2. ECCENTRICITY is as easy to mold as concentricity in producing sinterings. Thus, camming surfaces are readily developed. The part shown at the right not only has such a cam, but also a knurled section to anchor molded plastic.**

# DIE CASTINGS and SINTERINGS --- a useful combination for appliances

By O. E. LACKNER*

OTHER than the obvious application of cutting hair easily and giving a good service life; an electric hair clipper particularly a professional model, must meet certain other requirements.

- The body must be small enough so that it can be gripped by the average person and used without undo fatigue to the hand muscles.
- The weight must be kept as low as possible so that it can be used easily without the operator being conscious of much mass.
- The balance must be such that when gripped in a normal manner, the clipper does not tend to tip either toward or away from the area of operation.
- The motor must be capable of operation for considerable periods without over-heating.
- The case must be slip proof and a good electrical insulator.

All of these requirements have been designed into the line of clippers made by the John Oster Mfg. Co., of Racine, Wis. Both the smaller less expensive models and the professional models have all the desirable features incorporated in them.

In order to secure a case that has a good grip and is, at the same time, an electrical insulator; a plastic is used. This material has all of the good features desired, but lacks

---

***Production engineer, John Oster Manufacturing Co.**

the necessary mechanical strength and dimensional stability that would enable its use as a mounting medium for the motor and other components.

Since the motor must be quite small and at the same time deliver a relatively high output torque for its size, coupling between the rotor and stator must be better than average. The requirement for low heat loss further influences the air gap size.

In order to have a rigid mounting that can be made and held dimensionally accurate, a zinc die cast cradle is used as a motor mount. This cradle is shown in Figure 1. Because of the strict requirements for both size and accuracy of the air gap, the foundry, the Racine Die Casting Co., of Racine Wis., *must meet close tolerances, generally ± 0.003.*

### Sinterings serve for bearings and power transmission

To stand up under the rather high speed and relatively heavy service requirements of an electric hair clipper, the main motor bushings are porous bronze impregnated with oil. These bushings, one of which is shown in Figure 1, have a spherical shape that bears against a spherical seat in the zinc die casting and a hexagonal shank to anchor them in the plastic body. Through the use of these bushings, alignment of the motor shaft and rotor can be done with considerable precision.

The bushings, made by the U. S. Graphite Co., of Saginaw, Mich., are relatively standard in all respects except that the bore must be concentric with the spherical diameter within 0.002 TIR. Design of the bushing is of considerable interest since *it is one of the few pieces made from metal powder where the upper punch on the forming press carries a relatively deep cavity and the powder is forced up into it during molding.*

To transmit the rotary motion of the motor to the reciprocating motion of the cutter blades, the Oster Co. uses a brass cam made by International Powder Metallurgy Co., of Ridgway, Pa. The motor shaft carries a worm which, in turn meshes with a phenolic gear.

Since operation of the clipper is entirely dependant upon proper functioning of this cam, extreme dimensional accuracy is required. *Nearly all dimensions are held to ± 0.002 except the bore which has a total allowable variation of only 0.0008.* Even the knurl is held to a total variation of its diameter of only 0.003 while the knurl diameter and the bore are concentric within 0.003 TIR. This accuracy is possible only because the sintered part can be accurately sized as a final manufacturing step.

Then it's Time to Call

Electronicast, INC.

for Centrifugal Investment Castings

You may be stumped for a complex part just like the manufacturer that needed the part shown above.

It had to be made of stainless steel and maintain close tolerances. Machining was prohibitive in cost, and the part was too complex for other types of casting. Then they called Electronicast. Here, skilled engineers quickly solved the problem with investment casting, and at a cost the manufacturer didn't dream was possible.

We'll help solve your small and complex parts problems, too. We'll produce them in stainless, Alnico, or any ferrous or non-ferrous metal to tolerances as close as ±.005". Write for literature today.

Typical Electronicast Investment Castings

ELECTRONICAST, INCORPORATED

1729 WEST FULTON STREET • CHICAGO 12, ILLINOIS

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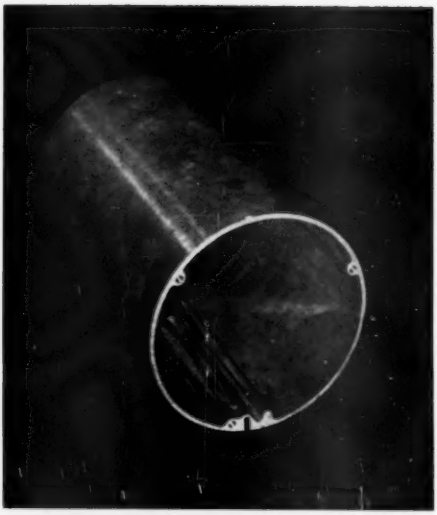


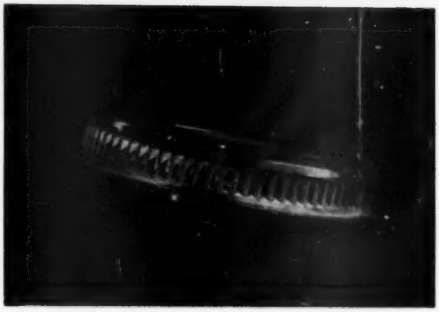
**THE DRUM**

DIE CAST

1. Ream bushing hole.
2. Turn O. D.
3. Mill continuous 3/32 cast slot to 1/8 wide.
4. Drill & tap hole for set screw.

SAND CAST

1. Bore & ream bushing hole.
2. Drill seven small holes.
3. Locate & drill one blind hole in inside boss.
4. Mill four discontinuous paper gripper slots 0.050 x 1½.
5. Mill continuous slot 1/8 wide.
6. Turn O. D.
7. Face both ends.
8. Turn bore to fit flange on end piece.
9. Drill & tap hole for set screw.



**THE END PIECE**

DIE CAST

1. Ream bushing hole.
2. Clean up flange.

SAND CAST

1. Cut teeth.
2. Bore four small holes.
3. Bore & ream bushing hole.
4. Cut & face flange.
5. Face outside surfaces.
6. Clean up rod hanger.

# Proper balance of rotating drum obtained by DIE CASTING

By M. J. AJAM*

ONE of the more important considerations involved in the design of an office type duplicating machine is the inertia of the printing drum. When the machine is operating in a fully automatic manner, it is desirable to have a printing drum of considerable mass to act as a stabilizing fly wheel, giving smoother operation. When, however, the machine is hand fed, the printing drum must stop after each revolution and reverse slightly against a positive stop before the next sheet is fed through. This operation requires a printing

drum of low mass so that the inertia on starting and stopping will be as low as possible.

In addition to the inertial characteristics which must be considered, the drum should be of a material that will not be deformed in any normal use; that is, resistant to both atmospheric corrosion and attack by inks and solvents, and which, finally, can be fabricated in a relatively complex shape at a moderate cost.

When all of the various factors were considered, the Standard Duplicating Machine Corp. of Everett, Mass., chose die casting as the most economical method of manufacture and aluminum as the preferred material. However, at the time the design was finalized, the price differential between zinc and aluminum was great enough so that a zinc die casting was by all means the more economical and was, therefore, selected.

The two zinc die castings that comprise the printing drum are shown. These castings are fully machined and ready for installation in a duplicating machine. The Doehler-Jarvis Corp. of Toledo, Ohio produces these castings.

To fully appreciate the great savings both in cost and machining operations, that are made because of the use of die castings, operations required to finish the die cast drum and a sand cast drum can be compared in Table 1.

From this sequence of operations, the possible savings made by die casting are obvious. Still other economies are present that the tabulation do not show.

On the die cast drum, the only precision machining methods required are turning the OD to the desired concentricity with respect to the bushings and milling the cast slot from 3/32 to ⅛ wide. This latter operation is also the only one requiring a fixture.

On the sand cast drum, all of the turning operations require a fair degree of precision. jigs would be required for all drilling operations and the same fixture for the milling operation as on the die casting.

Another very real saving, but one harder to evaluate is the reduction in inspection. With the decrease in the number of machine operations, the number of, and the time required, for inspections is materially reduced. In a sand casting, the likelihood of rejections due to flaws uncovered by machining operations is far greater than rejects in the die castings.

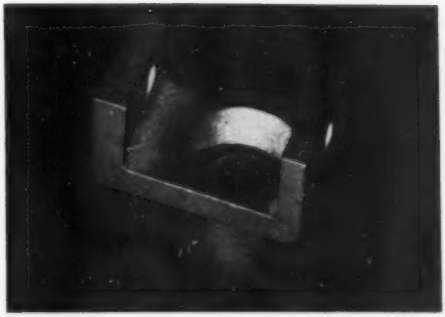
Finally, as a die casting, the part could be made of zinc while as a sand casting, only aluminum could have been used at a considerably greater metal cost and much greater scrap loss due to machining.

---

# Mitre gear housing by INVESTMENT CASTING

ANOTHER part on the Coronet Duplicator, which uses the drum described above, is made by a PMM process. The mitre gear housing shown at the right is a beryllium copper investment casting made by the Hitchiner Mfg. Co. of Hartford, Conn.

While this piece was originally designed as an investment casting, it is estimated that the cost of producing it in finished form is at least 50 percent below the cost of any other method. As received from the foundry, the housing must have both shaft holes reamed to size (the beryllium copper acts as a bushing) and the OD of the leg turned to meet the concentricity requirements with respect to the bore. The casting as furnished by the foundry is held to dimensional tolerances of 0.005 on all dimensions, the two sides of the housing are held to a parallelism tolerance of 0.005 and the 90 degree angles within ¼ degree.



*Chief Engineer, Standard Duplicating Machines Corp., Everett, Mass.

# PERMANENT MOLD CASTINGS in zinc where quantities are limited

By L. PETERS*

ONE important reason for the use of permanent mold castings is to secure economy of production in those cases where the number of parts involved is not great enough to warrant the cost of dies and the higher setup time involved in die casting. Typical of this class of castings are the parts cast in zinc by the K & M Metal Casting and Modeling Co. of Brooklyn N.Y., for the Audicraft Corp. of Brooklyn, N.Y.

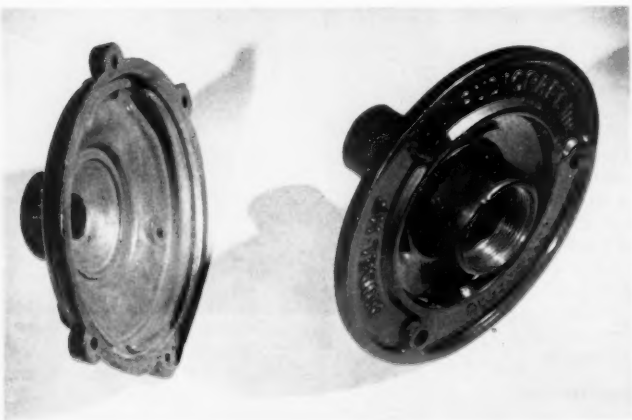
Figures 1 and 2 show four permanent mold castings now being used by Audicraft. All of these castings have been designed with two ideas in mind. In the first place, they must fulfill their assigned tasks, functionally. Used as they are in loud speakers for public address systems, the castings must give rigidity of assembly and be able to withstand considerable stress, particularly shock stresses that may come when a speaker is mounted on a sound truck.

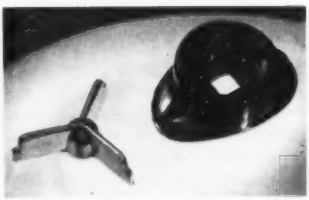
The speaker is made up of three separate horn sections so designed and positioned that they give the effect of a single horn of considerably greater length. Obviously, these three sections must be held in precise position with respect to each other and this position must be maintained under all conditions. Two permanent mold castings are depended upon to do this job.

Figure 3 is a schematic drawing of a horn assembly showing how use is made of the base casting and the propeller casting

continued on page 58

*Chief Engineer, Audicraft Corp.





**1. RIGID ALIGNMENT OF COMPONENTS** and support of the entire speaker are assured through the use of these permanent mold castings, above.

**2. THE DIAPHRAGM AND MAGNETS** of a public address speaker must be weather tightly housed and the assembly mounted to resist shock. Permanent mold castings do both jobs for Audicraft.

# A machine tool builder employs the unique properties of ZINC DIE CASTINGS

By L. E. JENSEN*

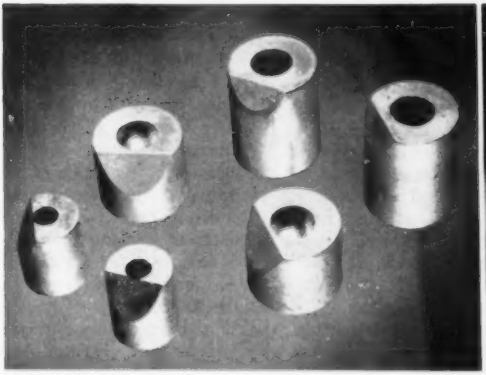
IN building machine tools such as the drill press shown, one does not normally consider the use of die castings except for housings and covers. Where, however, considerable wear may occur or where maintenance of alignment is required, the designer usually turns to some ferrous or copper-base material. In the Famco drill presses, however, zinc die castings are used in just such applications and their use is not predicated upon low manufacturing cost only, but also on superior performance. In fact, *the lock plugs to be described would not, in all probability, function satisfactorily if made from any other material than zinc or aluminum, and die casting is the most logical method of fabrication.*

Three different sizes of lock plugs are shown in Figure 1. These plugs are used to lock the drill press head, table or quill in any desired position. All three of them operate against ground and polished steel and, for proper functioning and long life, these pieces must not be marred or dented. From this, it follows that the lock plugs must be considerably softer than the column so that they will yield slightly to grip the column when tightened. At the same time they must have sufficient mechanical strength to resist upsetting and associated

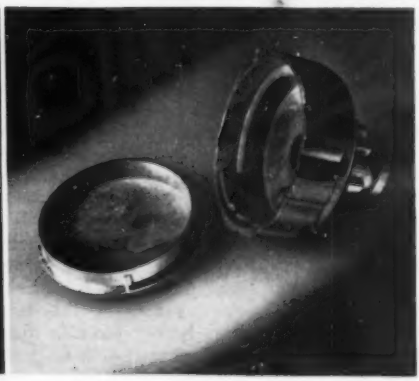
continued on page 59

*Design Engineer FAMCO Machine Company.

**1. SOFTNESS that permits yielding, and strength that resists upsetting, are useful qualities of zinc die castings for these lock plugs.**



**2. CONTINUALLY UNDER LOAD, these die castings house the quill return spring.**



**THE investment casting process has become an important tool in modern aircraft production. Our country's airforce program is committed to the production in adequate quantities of military aircraft that in design and performance are the very best that can be made. In constantly striving for perfection, today's designs may be obsolete tomorrow. This race against time and obsolescence in the aircraft industry makes necessary a quick conversion of aircraft in the blueprint stage to the finished article in quantities to meet our military requirements. For many structural parts of aircraft mechanisms, investment castings provide a means of getting into relatively quick production. The use of hard-pressed machine tool facilities is avoided and costly special tooling is by-passed with investment castings. Another important factor is the ease of design changes.**

# Use of INVESTMENT CASTINGS in aircraft structural parts - Part 1

By
**ARTHUR C. WILLIAMS**
Special Products Div.
Crucible Steel Company of America

assisted by
**JOSEPH H. MASSA**
Standards & Materials Dept,
Republican Aviation Corp.

IN the design of aircraft mechanisms, limited functional space is one of the principal handicaps faced by the design engineer. This condition is closely allied with the need for weight control and low factors of safety. These requirements, therefore, generally result in the necessity for designing compact mechanisms with small intricate component parts containing offsets, undercuts, thin sections, recesses and bosses. This type of design is usually very difficult to fabricate by machining or other conventional manufacturing processes. These component parts, however, are often ideally suited to fabrication by the employment of investment castings of high strength steels.

The successful application of investment casting in aircraft structural part production requires first of all a thorough working knowledge by aircraft designers and engineers of the advantages and limitations of the investment casting process. This knowledge consists roughly of dimensional tolerances that can be held, casting hazards and the mechanical properties of various kinds of steel in investment-cast form. Having this basic knowledge it is possible to lay out a mechanism with only its function in mind and within the necessary space limitation, weight control and low margin of safety. The component parts of the mechanisms designed in this manner are often so intricately shaped that they cannot be produced practically or economically by any manufacturing process other than investment casting.

Aircraft designers and engineers can best obtain clear understanding of the investment casting process by close liaison with investment casting makers. Before designs are completed an investment casting engineer should be called in to study the parts expected to be produced by investment casting. At this

meeting, casting tolerances can be worked out, casting hazards pointed out, proper steel grades selected, expected physical properties determined and specifications governing their production and inspection decided upon. After several meetings of this kind between aircraft designer and investment casting producer, the designer will soon acquire adequate knowledge of investment castings to turn out designs on his own.

If a designer is not thoroughly familiar with investment castings, his drawings usually contain some feature to which most investment casting producers will take exception. When these exceptions are taken, much time is lost by the necessity of purchasing department referral of qualified casting quotations to engineering for study and comments. The designer often has to be consulted to see if changes in the drawing will impair proper functioning of the part. Often a change in one part of an assembly will require revisions of other parts. From this, it is evident that designing engineers will save time and extra work by making certain that the drawing of an investment casting is practical in every detail for casting production.

## Tolerances and casting hazards considered

The matter of dimensional tolerances that can be held in investment casting is not too difficult to determine. Any experienced investment casting engineer can be called upon for this kind of informaton if the designer requires it. A tolerance of ± .005 for dimensions up to one inch and an additional ± .005 for each inch for dimensions greater than one inch is a fairly good rule-of-thumb on casting size control. Closer tolerances can be held if necessary under certain conditions but an inexperienced designer should consult a casting producer before specifying any closer tolerances. As a matter of economics, the general tolerances on a drawing of a part should be made as broad as possible and the number of critical dimensions held to a minimum.

It takes a good deal of experience to detect casting hazards as they very often are not discovered until the first castings are made. The designer must first understand that a wax or plastic pattern must be made for each casting by injection into a split mold which requires a parting line. Undercuts and holes are made by inserts in the mold that are either removable with the injected pattern and subsequently withdrawn from the pattern or the insert may be fixed in one side of the mold. Thus, no draft is required on any of the outer surfaces or slots and holes in the casting but there cannot be any back-draft or interference to prevent the opening of the mold or with-

continued next page

**TABLE 1: Mechanical properties for modified 4140 steel investment casting**

| TENSILE STRENGTH RANGE psi | Yield strength 0.2% off-set Min. psi | % ELONGATION Min. | HEAT TREATED CONDITION |
|---|---|---|---|
| 90/125,000 | 70,000 | 12.c | Normalize & temper. |
| 125/150,000 | 90,000 | 10.c | Normalize & temper for small sections; oil quench & temper for large sections. |
| 140/165,000 | 120,000 | 8.c | Oil quench & temper. |
| 150/175,000 | 130,000 | 6.c | Oil quench & temper. |
| 160/185,000 | 145,000 | 4.c | Oil quench & temper. |
| 180/195,000 | 165,000 | 3.c | Oil quench & temper. |

drawal of inserts in one direction.

The designer must secondly realize that a casting must be gated, and into such a surface that the gate can be readily removed. Also to assure radiographically sound castings the gate must enter the heaviest section of the part. Two or more heavy sections separated by thinner sections require multiple gating. Sharp inside corners between heavy and thin sections are to be avoided wherever possible. Long, thin, unsupported sections usually incur distortion, and straightening operations are necessary to bring these sections within the normally expected investment casting tolerances. It is often less expensive to drill a hole in a casting than it is to core it.

The subject of mechanical properties of investment castings is the least understood. Except for the high temperature alloys, and some stainless grades, no specifications covering physical properties of investment castings exist.

Federal Specifications QQ-S-681b for steel castings was made for sand castings and cannot be applied completely to investment castings. The latter differ considerably from sand castings in size, method of production

continued on page 61

**TABLE 2: Comparison of investment cast with wrought specifications at three tensile levels, as determined by actual tests**

| | TENSILE STRENGTH-psi | YIELD STRENGTH-psi | ELONGATION % | REDUCTION OF AREA |
|---|---|---|---|---|
| Wrought Specification Mil H-6875 | 125,000 Min. | ——— | 17.0 Min. | 55.0 Min. |
| Casting Specification by Republic Aviation Corp. | 90/125,000 | 55,000 Min. | 8.0 Min. | ——— |
| Actual Test-4140 Heat Treated Casting-Test No. 1 | 121,000 | 98,000 | 19.8 | 38.5 |
| Test No. 2 | 124,000 | 96,000 | 13.7 | 35.6 |
| Test No. 3 | 124,000 | 93,000 | 17.0 | 41.7 |
| Wrought Specification Mil H-6875 | 150,000 Min. | ——— | 14.0 Min. | 52.0 Min. |
| Casting Specification by Republic Aviation Corp. | 140/165,000 | 112,000 Min. | 6.0 Min. | ——— |
| Actual Test-4140 Heat Treated Casting-Test No. 4 | 150,000 | 125,000 | 9.2 | 37.1 |
| Test No. 5 | 150,000 | 137,000 | 8.8 | 24.6 |
| Test No. 6 | 151,000 | 134,000 | 11.3 | 37.7 |
| Wrought Specification Mil H-6875 | 180,000 Min. | ——— | 12.0 Min. | 47.0 Min. |
| Casting Specification by Republic Aviation Corp. | 170/190,000 | 138,000 Min. | 3.0 Min. | ——— |
| Actual Test-4340 Heat Treated Casting-Test No. 7 | 188,000 | 174,000 | 6.4 | 11.8 |
| Test No. 8 | 180,000 | 169,000 | 5.3 | 20.2 |
| Test No. 9 | 182,000 | 170,000 | 6.9 | 21.6 |

PMM

# Finishing Section

## SURFACE FINISHING

**Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.**

**A Section Devoted to Specialized Finishing of**

**Die Castings • Investment Castings • Powder Metal Parts**
**Permanent Mold Castings • Plaster Mold Castings**

# CLEAR PROTECTIVE COATINGS over chromium plate systems

By GEORGE LIM POY*

THE conventional process of chrome-plating consists of copper plating over a base metal, whether zinc die cast or pressed steel, followed with a protective coat of nickel and finished with a bright, abrasion-resistant coat of chromium plate.

An enormous quantity of special nickel and chromium alloy are required in the production of modern military equipment. Consequently, the government has imposed restrictions as to the end uses of both metals.

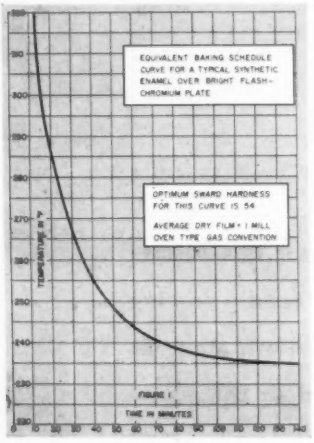
Because of present restrictions, the electro-plating industry has resorted to a system consisting of copper over a base metal and then a coat of "flash-chrome". This system does not afford the outdoor protection of conventional chromium plate, and the electro-plating industry has called upon paint manufacturers to develop a water-clear protective coating which will increase the outdoor durability of the copper-flash chrome system.

## Protective coating materials

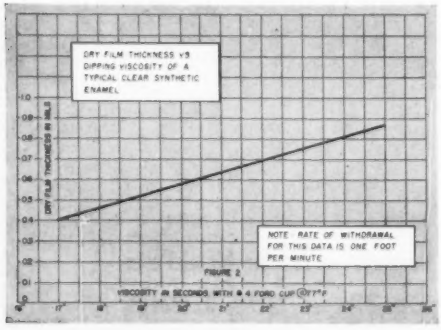
In general, clear protective coatings for chromium plate can be classified into two categories:

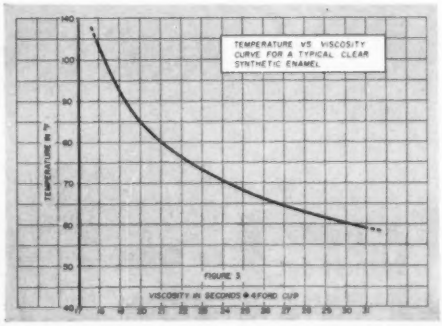
### 1. Synthetic enamels

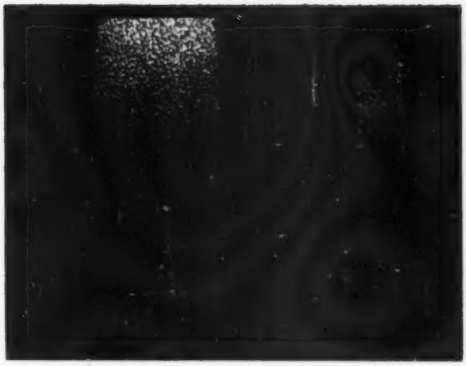
Synthetic enamels are usually formulated with an alkyd resin modified with hardening agents such as melamine or unreaform-aldehyde type of resins. Various additives are also incorporated to strengthen certain characteristics expected of the enamel. Once formed, this type of film becomes virtually insoluble and infusible.


EQUIVALENT BAKING SCHEDULE CURVE FOR A TYPICAL SYNTHETIC ENAMEL OVER BRIGHT FLASH-CHROMIUM PLATE
OPTIMUM SWARD HARDNESS FOR THIS CURVE IS 54
AVERAGE DRY FILM = 1 MILL
OVEN TYPE GAS CONVENTION
TEMPERATURE IN °F
TIME IN MINUTES
FIGURE 1

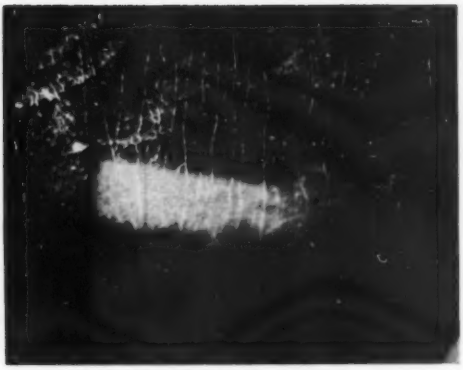
**THREE CHARTS pertaining to clear synthetic enamels applied over chromium plate are presented left and below.**


DRY FILM THICKNESS VS DIPPING VISCOSITY OF A TYPICAL CLEAR SYNTHETIC ENAMEL
DRY FILM THICKNESS IN MILS
NOTE: RATE OF WITHDRAWAL FOR THIS DATA IS ONE FOOT PER MINUTE
FIGURE 2
VISCOSITY IN SECONDS WITH #4 FORD CUP @77°F


TEMPERATURE VS VISCOSITY CURVE FOR A TYPICAL CLEAR SYNTHETIC ENAMEL
TEMPERATURE IN °F
FIGURE 3
VISCOSITY IN SECONDS #4 FORD CUP



**4. GEOMETRIC GASSING pattern of clear synthetic baking enamel over chromium plated zinc die casting. 20X**



**5. MICROSCOPIC CRACKING of chromium plate over zinc die casting. 20X**

An equivalent baking schedule curve for a typical heat converted clear synthetic baking enamel is shown in Figure 1. The curing process is a function of time and temperature of which the limits are the respective asymtotes. Any point on the curve will give the optimum time and temperature requirements for a complete cure of the synthetic enamel system.

For maximum adhesion and outdoor durability, the heat-converted synthetic enamels are much superior in every respect to air-drying enamels.

**2. Lacquer and Solvent Soluble Films**

In this type of coating, the film is formed by evaporation of the solvent in which the material is dissolved. Some oxidation or polymerization may take place, but these films are still solvent soluble.

Nitro-cellulose, plasticizers, and resins are the main ingredients in lacquers. Generally lacquers lack the inherent adhesion of baked enamels over a smooth surface, and therefor, are normally used on parts not directly exposed to the weather.

There are also numerous types of organic copolymers which are readily soluble and will give suitable films upon evaporation of the solvent. Polymers such as vinylidine-chloride and methacrylates are now employed as film forming materials. The vinylidine chloride-acrylonitrile copolymer, will give excellent humidity and salt spray resistance. Since most of these materials are of high molecular weight structures, it becomes necessary to make a 100% or more reduction with a solvent to insure a smooth film during common procedures of application. The amount of non-volatiles in the integrated film then, is at a minimum. Consequently, the plated parts have to be recoated two or three times to obtain an adequate dry-film thickness for out-door protection.

## Surface cleaning

It is imperative from the standpoint of adhesion and durability that the plated part be thoroughly clean prior to application of the clear protective coating. The presence of buffing compounds or residues from the plating or cleaning operations will impair the adhesive and protective qualities of any coating. The following is a recommended cleaning cycle of copper-chrome plate:

1. **Degreasing operation** — serves to remove waxes and oil soluble soil incurred in handling and buffing operations.
   a. 1st choice—Trichloroethylene type.
   b. 2nd choice—Mineral spirits type.
2. **Alkali wash**—to remove water soluble soil with tri-

---


***The Author**

**George Lim Poy is a formulator in the Automotive Research Department of Rinshed-Mason Co. of Detoit. Mr. Poy is a chemical engineering graduate of University of Michigan and is active in the Detroit Paint & Varnish Production Club.**

sodium phosphate type maintained at 150 to 180F.

3. **Hot water rinse**—to remove all traces of alkali. For maximum cleansing efforts, the water should be demineralized and maintained at 180F. A demineralized cold water spray is preferred after this operation.

4. **Chromic acid rinse**—final cleansing operation. The concentration of chromic acid (chromium tri-oxide) should be approximately 1½ ounces by weight in 100 gallons of demineralized water maintained at 150F. Additions of wetting agents are optional.

5. **"Blow Off"**—the parts are blown off with preheated compressed air to reduce water spots. The parts must be completely dry before application of a protective coating.

The chromic acid rinse recommended in the above cleaning cycle renders optimum adhesion of protective coatings to chromium plate. W. D. McMaster and his associates of General Motors Research Laboratories found that a rinse with a weak chromic acid solution served not only to neutralize any traces of alkali but also convert the active salts to less active one. Upon further investigation, it was also found that salts of various minerals in water, though only in few parts per million, were also factors detrimental to the adhesion of protective coatings. Therefore, demineralized water is highly recommended in rinses and aqueous solutions of the cleaning cycle.

## Application

Clear protective coatings for chromium plated parts can be applied by dip coating, manual spray, or electrostatic spray. Of these, the dip coating process is by far the most thorough method of application. It not only gives a uniform, glass-smooth film, but also provides extra protection by virtue of coating all the intricacies and contours of parts. For this, our thanks to the ingenuity of production engineers who devise various special conveyor racks which permit proper drainage of surplus coating material in recessed areas.

Regardless of the method of application, it is of paramount importance that a proper dry-film thickness of clear coating be maintained on the plated parts. Adequate out-door protection will be afforded those parts which have a dry-film thickness between 0.7 to one mil.

The dry film thickness of a synthetic clear enamel varies directly to the dipping viscosity. This relationship is shown in Figure 2.

## Accelerated tests

The two most widely used methods of testing adhesion of

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Applied in one quick dip
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Most easily controlled
Lowest possible cost

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a clear protective coating over chromium plate are:

(1) 100% Humidity Test,

(2) 20% Salt Spray Test[2].

Both of these tests are conducted on a continuous basis until failure occurs. Some manufacturers recommend that the clear protective coatings be scribed through to the metal prior to the submission of humidity and salt spray tests. Specifications for the humidity or salt spray test vary from 48 to 120 hours without failure to the clear protective coating.

If, however, heat converted clear coatings are not adequately cured, premature failure is inevitable. It should be noted, however, that other than actual field results, only a Florida exposure of clear coated parts will give an accurate simulation as to the serviceability under most adverse weather conditions.

### Factors affecting clear protective coatings over chromium plate

Adhesion is generally regarded as an inherent quality of the protective coating. In cases where there is lack of adhesion regardless of the type of protective coating used, the cause may be traced to the "passivity" created in plating operation[3]. It is known that during the electro-plating of chromium and other iron-group metals, the solution of these as anodes may be displaced by other reactions without the formation of visible films on the anode.

Normally the anodic solution of this group of metals requires considerable polarization, however, at higher current densities an oxygen evolution sets in and the metal becomes "passivated". When a protective coating is applied to a passive part, adhesion failure is encountered immediately in both humidity and salt spray tests.

The passivity effect can be reduced by proper maintenance of plating bath concentrations

continued next page

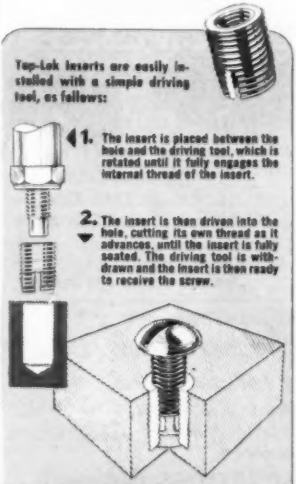
*Tap and insert in one operation—*

**—with TAP-LOK INSERTS***

The Tap-Lok Insert offers an effective, low-cost method of preventing stripping of tapped threads in softer-than-steel materials. It is a steel or brass bushing threaded internally and externally, and provides a hard, long-wearing thread surface.

Slotted segments at one end of the insert enable it to tap its own thread as it is turned into a cored or drilled hole equal in size to a tap drill hole for its external thread. This self-tapping feature eliminates the separate tapping operation required by other types of bushings. The saving in time and labor makes it the most practical and economical method of tapped thread protection that has ever been devised.

The insert retains its seat firmly against vibration. It affords maximum torque-and-pull resistance and is not subject to the time-consuming failures of molded-in and cast-in inserts. Widely used as original equipment, the Tap-Lok Insert is ideal also for salvage and repair of stripped threads.


Tap-Lok inserts are easily installed with a simple driving tool, as follows:
1. The insert is placed between the hole and the driving tool, which is rotated until it fully engages the internal thread of the insert.
2. The insert is then driven into the hole, cutting its own thread as it advances, until the insert is fully seated. The driving tool is withdrawn and the insert is then ready to receive the screw.

**Send for descriptive folder.**

*Also manufacturers of Groov-Pins for positive locking press fit.*

*Reg. U.S. Pat. Off.

**GROOV-PIN CORPORATION**

**Hendricks Causeway, Ridgefield, New Jersey**

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at regular intervals, preferrably between plating cycles.

In cases where geometric gassing patterns are encountered in clear synthetic baking enamels over chromium plated zinc die cast as in Figure 4, the causes can usually be traced to excessive current densities. Upon careful examination of the part under a microscope, a crazed network of cracks can be detected. These microscopic cracks as shown in Figure 5 are caused by improper plating conditions which usually occur at high current density areas. When the clear enamel is applied over the microscopic cracks, the enamel cannot overcome the surface tension of said cracks, thus entrapping air or gas. As the temperature in the oven is increased, the trapped gasses increase in volume and ultimately manifest themselves as minute air bubbles in the clear enamel film.

The following are remedies for microscopic cracking of chromium plate at high current density areas:

1. Move parts to be plated ½" or 1" further away from anode.
2. Decrease plating current.
3. Increase temperature of plating bath.
4. Adapt a "thief" to detract excess current from high current density areas.
5. Maintain proper current density per area of plated surface at all times.

Blistering of chromium plate over zinc die castings when subjected to elevated temperatures is usually due to the following reasons:

1. Impurities in the zinc die cast metal.
2. Excessive porosity in the zinc die cast metal.
3. Entrapped gasses during the plating operation.

These conditions can be rectified by careful control of the purity of the die cast metal and proper molding procedures.

There is no doubt that a protective coating over chromium plated parts affords significant protection to the entire system. Several of the quality-minded manufacturers currently using this system have indicated their intention to retain the use of protective coating even after nickel has been made available.


## ACKNOWLEDGEMENTS

The author appreciates the information and facts supplied by Messrs. Ralph Wirshing, Head; W. D. McMasters; and Gene Litehauser of the General Chemistry Division of the General Motors Research Laboratories.


## REFERENCES


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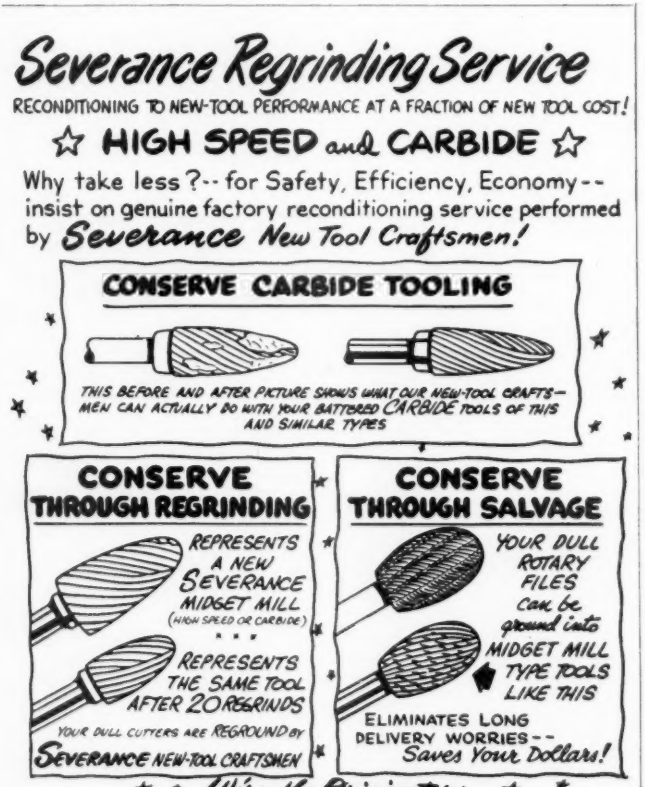
2. A.S.T.M. *Standards on Paint, Varnish, Lacquer & Related Products*. Dec., 1949, pp. 506.
3. McMaster, Wardley D., The Problem of Painting Bright Chromium Plate, *Plating* Magazine, July, 1951.

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PART TWO

# Chromate surface treatment for PRECISION MOLDED ALUMINUM

By R. STRICKLEN*

**(Editor's Note: In Part One of this paper, Mr. Stricklen offered extensive evidence of performance characteristics, corrosion resistance, paint adhesion, electrical properties and weldability of chromate coatings.)**

## Applying the finish

**Cleaning** — The preparation methods used for this acid chromate process are conventional and are selected after consideration of the alloy composition, the type and extent of the surface contamination, and the end result desired. The choice of the cleaining system rests with the user. Good results can be obtained with any system. Naturally, though, best results are obtained from complete cleaning.

Pre-cleaning, where necessitated by large quantities of greases, oils, drawing and cutting compounds, etc., may be accomplished by solvent vapor or emulsion degreasing. Final removal of traces of organic material is accomplished by alkali soak cleaning. If etching is desired, formulations based on sodium hydroxide, sodium carbonate and/or tri-sodium phosphate can be used. If no etching is permitted, any of a number of proprietary inhibited alkaline cleaners will be found satisfactory.

If an etch type alkali cleaner is used a slight smut will be formed on all types of aluminum except those of high purity. It consists of alloying constituents insoluble in the cleaning solution. If an inhibited cleaner is used, natural oxides or oxides from heat treating operations remain on the surface. The smuts or oxides are removed most thoroughly and economically by certain proprietary acid chromate formulations which are generally sold as a preparation for spotwelding.

These deoxidizers are used in water solution at room temperature. Immersion of the work from 30 seconds to 5 minutes usually suffices for producing a chemically clean surface. Thorough rinsing should follow both the alkali and the acid cleaning steps. When high silicon are etched, mixed hydrofluoric and nitric acids are required to remove the smut.

Where space limitations or economic considerations prohibit the installation of the recommended cleaning cycle, a one-stage method is used, but at some sacrifice in the cleaning speed and degree of corrosion protection.

**The solution** — The concentration of the Iridite solution depends upon whether it is to be applied by spraying, dipping, flow-coating or brushing. Other factors in solution concentration are the time cycles available for the various methods of application and whether a clear or yellow film is required. Parts can be processed as piece parts, strip or in bulk in conventional manner.

A typical dip solution is made up as follows:

| | |
|---|---|
| Iridite # 14 | 3 oz. per gal. of solution |
| Temperature | 75 to 95 F |
| pH | 1.5 to 1.7 |
| Time | 10 sec. to 5 min. |

The optimum time of immersion for a clear treatment is 10 to 30 seconds; the optimum time for the yellow coating is 2 minutes. On some few alloys, additional protection can be obtained by extending the time of

*Development Engineer, Allied Research Products, Inc.

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immersion up to 3 to 5 minutes.

In some applications, immersion times of only 10 to 30 seconds may be impractical from the standpoint of material handling. In such cases the time for forming clear coatings can be extended by reducing the concentration of the Iridite No. 14 powder to 1.5 oz. per gal. of solution and by raising the operating pH to approximately 2.2.

For typical spray application, the solution is operated at 1.5 oz. per gal. of solution and a pH of 1.8 to 2.0 A protective film is obtained in 10 to 30 sec. Conventional stainless steel spraying equipment is satisfactory. Brush or flow coat application are used either on assemblies too large for tank immersion or for touching up on small areas. The normal 3-oz.-per-gal. concentration is used after adequate chemical or mechanical cleaning.

The solution is controlled by a simple titration to determine if the solution is within the range of effective concentration. Periodic electrometric pH measurements are required to maintain uniform activity. When the concentration of the solution is correct and further pH reductions are necessary, this can be accomplished by the addition of small quantities of nitric acid.

Due to its low operating temperature and broad range, the solution seldom needs heating or cooling. No fumes or spray are given off. Consequently, no ventilation is required. Agitation of the work, beyond that necessary to insure complete coverage of all surfaces, is neither required nor recommended. However, when agitation is inherent in the treating equipment, such as in spraying, the effect is compensated for by pH adjustments.

Conventional drying methods are used to remove the rinse water from the part. Usually after a dip in a hot rinse, hot air will assist in more rapid evaporation of the water. Centrifugal drying is quite advantageous in bulk processing.

One of the latest applications of Iridite No. 14 is preparation of aluminum for adhesive bonding. With properly chosen adhesives it is possible to obtain bond strength equal to the strength of attached rubber and plastics. Further evaluation of this property must be made but it is typical of the new applications developing.

### BRASS GROUP ENTERTAINS

The Metropolitan Brass Founders Association, Inc. have invited all members, non-members, metal suppliers, equipment manufacturers to their Forty-Second Anniversary Show & Dance, Friday Evening, Oct. 31, 1952 at the Hotel New Yorker, in New York City.

The membership includes non ferrous casters within a 50-mile radius of New York City producing castings in sand, permanent molds, lost wax process, precision or die casting.


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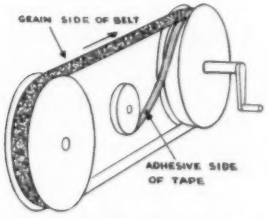
# HOW TO REINFORCE ABRASIVE BELTS

WHERE abrasive belts are to be subjected to excessive loads, they may be strengthened quickly and inexpensively with a backing of pressure-sensitive, Fiberglas-reinforced strapping tape. Investigation by the Product Engineering Department of Behr-Manning Corp. at Troy, N. Y., indicates that this simple modification may often permit the use of these belts for fast removal of metal and in fining operations formerly considered too severe for commercial equipment of this type.

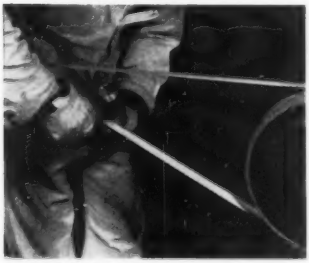



**MOUNT A ROLL of strapping tape on a spindle between the pulleys. Attach the lead end of the tape to the underside of the belt and rotate the belt and pulleys as shown.**

Reinforcement is accomplished by lining the cloth side of the belt with a lamination of the pressure-sensitive tape. A simple arrangement of pulleys can be set up to expedite the job, Behr-Manning engineers report. Two pulleys are mounted in tandem and the belt to be reinforced is placed over them. A roll of strapping tape is mounted on a spindle between the pulleys, and the lead end of the tape is attached to the underside of the belt. By rotating the belt, the tape will be drawn from the roll and pressed to the back of the belt as it passes over the first pulley.

In addition to increasing the tensile strength of the backing of the belts, this lamination of Fiberglas filament tape reinforces the belt joint and increases the crosswise rigidity of narrow belts ¾-in. or less in width. Thus, edge bowing and twisting are eliminated.

Replacing canvas or mattress ticking set-up belts with coated abrasive belts so strengthened does away with problems of wild grain marks, shedding and ravelling. It also reduces the annoyance of make-ready, and cuts set-up time.



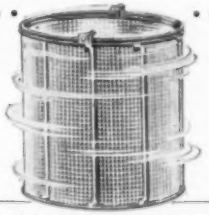
**POLISHING the flash marks from a sink trap with a reinforced abrasive belt.**


**DRIES SMALL PARTS *Faster–Better...***

***DOES IT FOR LESS!***

**Kreider Dryer** with auxiliary gas heating unit (illustrated). Auxiliary steam heating unit available; also standard model without auxiliary heating.

**Basket (shown below).** Heavy gauge steel woven mesh over steel frame. Capacity, 1140 cu. ins.



**Spin-Dries* up to 50 pounds in less than 2 minutes**

**Simple design** . . . careful engineering, sturdy construction assure trouble-free, low-cost maintenance operation. Operates at 625 r.p.m. on less than 1 h.p.

**No scarring or marring** . . . with Kreider Dryer. Centrifugal force holds parts immovable in basket . . . assures smooth, evenly dried surfaces, long-lasting luster, minimum "rejects".

**One man runs it!** Standard model Kreider Dryer occupies less than 6 sq. ft. floor space. One man tends—loads, unloads—keeps production moving, prevents expensive, time-wasting tie-ups.

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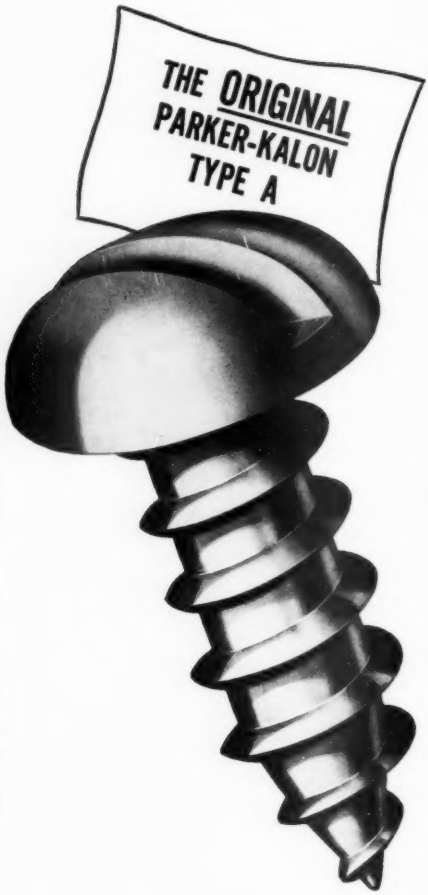

*"Screws are something like people. If they lose their heads under pressure—if they turn out to be 'softies'—if they don't 'square up', they can slow up a job for sure. We avoid that by specifying Parker-Kalon."*

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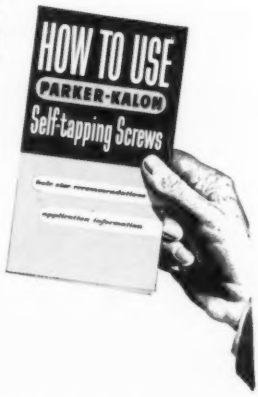


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# PMM USEFUL LITERATURE

**For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.**

## PROCESSES

**Reducing Costs by Investment Casting: No. 144**
Cost reduction through the use of investment castings is the theme of a new brochure offered by Casting Engineers. The new leaflet shows a large group of investment castings which represent savings of from 10 to 70 percent over cost of machining them.

**Stainless Steel Parts by Powder Metallurgy: No. 145**
In Vol 5, No. 6, of Nickel Topics published by International Nickel Co., Inc., is a news report on the use of prealloyed stainle s steel powder to produce self-lubricating bushings, corrosion re sistant filters and machine parts.

**Investment Casting Process Reviewed: No.146**
A review of the investment casting process has been written and published by Adapti Co. included are sections on designing for investment casting, metals that are cast, tolerances and an outline of some typical investment castings.

**Helical Gears by Powder Metallurgy: No. 147**
Reprints of an article describing helical gears produced by powder metallurgy are offered by Merriman B.os., Inc. Some details of manufacture, and functional characteristics of the sintered gears are included.

**Centrifugal & Vacuum Investment Castings: No. 148**
A folder from Electronicast, Inc., is devoted to the company's Electronicast process of centrifugal and vacuum investment casting.

**Casting Aluminum Onto Iron & Steel: No. 149**
The Al-Fin process for casting aluminum alloy so that it forms a molecular bond with iron or steel is the subject of 16-pg data book from Al-Fin Div. of Fairchild Engine and Airplane Corp. All standard casting methods, sand, permanent mold, plaster mold and die casting, can be used with this process to obtain bi-metallic units which combine selected physical properties of both metals.

**Alloy Selection for Investment Casting: No. 150**
A new booklet available from Arwood Precision Casting Corp. is devoted to the subject, "Alloy Selection and Design for Investment Castings."

**Casting Aluminum by Antioch Process: No. 151**
A description of the mold-making process called the Antioch Process for producing aluminum castings of high metallurgical quality is offered by Morris Bean & Co. In a 10-page engineering report on this high-precision casting technique, the process is described, metallurgical quality of castings explained, and other subjects such as dimensional accuracy and surface quality are covered in detail.

**Stainless Steel by Shell Molding: No. 152**
In an 8-page report, Cooper Alloy Foundry gives full information on production of stainless steel castings by shell molding.

**Investment Castings: No. 153**
A booklet offered by Microcast Div., Austenal Laboratories, Inc., presents the company's process for making precision investment castings and gives information on advantages of the process.

**Foundry Shows Its Laboratory Facilities: No. 154**
Hampden Brass & Aluminum Company has issued a brochure showing views of its radiographic and chemical laboratories for quality control of aluminum and brass castings. In 16 photos, various equipment for testing and inspection are displayed.

## MATERIALS & EQUIPMENT

**Two-Chamber Industrial Melting Furnaces: No. 160**
Operation of stationary & tilting type 2-chamber melting furnaces is explained and illustrated in a new 8-pg bulletin from Lindberg Engineering Co. Bulletin 560 shows equipment suitable for die casting, permanent mold casting, sand casting and centrifugal casting methods.

**Revised Copper & Copper Alloy Specs: No. 161**
A revised edition of "Copper and Copper Alloy Specification Index" has been released by The American Brass Co. The 28-pg publication is divided into 2 sections. The first lists more generally used copper alloys together with specifications of nine agencies; second lists specs in numerical order with brief description of material.

**Lathes, Shapers & Drill Presses: No. 162**
An 88-pg catalog just released by South Bend Lathe Works illustrates, describes and gives specs for all South Bend lathes, shapers and drill presses. Also included are attachments, chucks, tools and accessories.

**Ductile Cast Iron: No. 163**
Ductile iron which can be cast like gray iron, yet is as strong as mild steel is the subject of an explanatory folder from American Brake Shoe Co. The material is said to be so ductile it twists like twine.

**Chucking Tools with New Holding Method: No. 164**
"Roll-Lock" chucking tools, using a new holding method that takes advantage of elastic properties of metal, are described and illustrated in a 52-pg bulletin No. 17-50 from Scully-Jones.

**Ethyl Silicate for Investment Molds: No. 165**
In a 4-pg technical information bulletin, Carbide & Carbon Chemicals gives data on the use of ethyl silicate for investment casting molds. A number of compositions of investment material are given, along with a bibliography of references.

**Machine Tool Catalog: No. 166**
Cincinnati Milling Machine Co. has just released its 1953 machine tool catalog. In its 52 pages, the company presents machines for milling, lapping, grinding, broaching, die sinking, metal forming, flame hardening and cutter sharpening, as well as grinding wheels and cutting fluid.

## FINISHING

**Technical Report on Baking & Drying Ovens: No. 170**
Reprints of an address on the subject of baking and drying ovens given before a meeting of the American Gas Association are available from Young Brothers Company. The 21-pg report is fully illustrated.

**Technical Newsletter on Finishing: No. 171**
Vol. 22, No. 1 of Stevens Technical Newsletter published regularly by Frederic B. Stevens, Inc., contains widely diversified tips and references in the metal finishing field, including tin-zinc alloy plating, salt spray tests, planning a barrel finishing department and other references.

continued next page

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USEFUL LITERATURE
continued from page 47

### Vinyl Plastisol Rack Coating: No. 172

A new vinyl plastisol rack coating suitable for plating and conveyor racks is the subject of Bulletin RC-2 from United Chromium, Inc.

### Electro-Polishing Method for Stainless Steel: No. 173

Folder from Electro-Glo Company introduces an electro-polishing method for obtaining high brilliance on stainless steel. Details and statistics concerning the process are included. Two different baths are recommended for austenitic and martensitic grades.

### Metal Processing Chemicals: No. 174

Because of the wide range of their products for cleaning and surface conditioning metal, Turco Products has published a booklet to serve as a guide for Turco compounds used in the metal working industry. Included are many types of cleaners, plating materials, phosphating treatments, paint strippers and other specialties.

### Set-Up Wheel Abrasives: No. 175

Literature from The Exolon Company is devoted to their aluminum oxide abrasives which are graded and ceramically coated to increase adhesion to set-up wheels.

### Stainless Steel Fastenings: No. 176

A 20-pg catalog from Star Stainless Screw Company gives detailed product specifications to aid is selecting and ordering stainless steel fastenings.

### American Pattern Files: No. 177

Data on a complete line of Ameriran pattern files for industrial use has been made available by DoAll Company. Included are pitsaw, tapered, pillar and warding files.

### Liquid Honing of Dies by Vapor Blast: No. 178

Types of vapor blast machines of varying capacities suitable for surface finishing of dies, molds and castings are presented, together with specifications, in a folder on Liquid Honing with abrasive blast machines from Vapor Blast M'g. Co.

### Surface Active Agents for Metalworking: No. 179

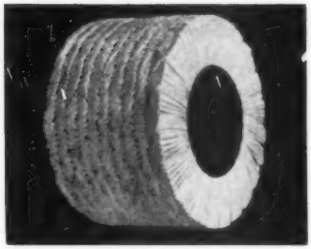
Prepared as a guide to speed processing and lower costs, a new 8-pg bulletin "Surface Active Agents for the Metalworking Industry" has been issued by E. F. Houghton. Theory & applications, a chart of physical properties, and reports from industrial installations, are included.

# PMM NEW PRODUCTS

**For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.**

## BUFFING WHEEL FOR HAND OR MACHINE OPERATION

*P-30 Finger Buff*
*Geo. R. Churchill Co.*



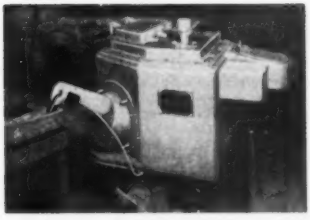
SPECIAL FEATURES: New type pleated buff construction traps and holds cutting compounds. Each pleated finger is set at the proper angle on the wheel to prevent gouging or streaking of the work. Suited for either manual or machine operation.

SPECIFICATIONS: Offered at same price as rest of regular line of Churchill Finger Buffs, the P-30 is produced in all types of cloth in sizes from 6" to 18" diam.

*For additional information Circle No. 198 on Reader Service Card*

## AUTOMATIC POURING UNIT FOR COLD CHAMBER DIE CASTING

*Ajaxomatic*
*Ajax Engineering Corp.*



SPECIAL FEATURES: Automatic pouring unit for pouring accurate amounts of molten metal into molds; designed particularly for pouring aluminum into the cold chamber of most available die casting machines. Molten metal taken from below surface of melt eliminating chance of pouring surface oxides or scum.

Acts as combined holding furnace & pouring unit, but is not a melting furnace. Temperature & alloy composition are maintained accurately by Ajax-Tama-Wyatt inductor which gives gentle electromagnetic stirring.

Ajaxomatic can be used also for zinc alloys, pointing way to economic use of cold chamber machines for that purpose.

SPECIFICATIONS: Has two self-contained electric control units; one section controls temperature, the other contains electronic timers and heating controls for automatic pouring. Weight of casting is selected on a dial in this section, and is repeated automatically from then on. Normal range is for castings from ½ lb. to 5 lbs. Castings up to 20 lbs. can be poured with slight modifications.

Can be linked with automatic controls on die casting machine for fully automatic operation. Eliminates ladling delay, thus increasing production rate on aluminum die castings.

*For additional information Circle No. 197 on Reader Service Card*

## EXHAUST HOOD FOR BUFFING AND POLISHING WHEELS

*Air-Flow Exhaust Hoods*
*Creative Development & Mfg., Inc.*

SPECIAL FEATURES: Curved airfoils that can be quickly adjusted close to surface of buffing wheel in the hood pick up "wind" created by revolving wheel, along with particles of metal, dirt & dust that normally follow around the wheel. This eliminates hazard and nuisance of polishing dirt being discharged onto the work and operator and into the plant atmosphere.

SPECIFICATIONS: Standard model adjustable for wheels up to 16" diam. and 7" wide. Can also be built to specification. Dust scoop in bin at bottom provides easy cleanout. Hood slides away on tracks to permit rapid wheel changes.

*For additional information Circle No. 196 on Reader Service Card*

## JOINT SEALING COMPOUND FOR NON-FLAM HYDRAULIC FLUIDS

*Leak Lock Joint Sealer*
*Highside Chemicals Co.*

SPECIAL FEATURES: Joint sealing compound prevents leaking of tricresyl phosphate (non-flammable hydraulic fluid) at joints and flanges. Available in 1 1/3 oz. tubes and pint cans.

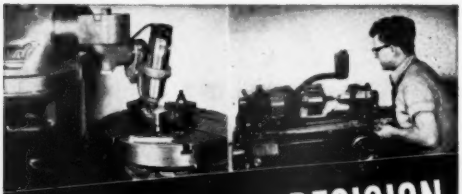
*For additional information Circle No. 199 on Reader Service Card*

### NEW PRODUCT BRIEFS

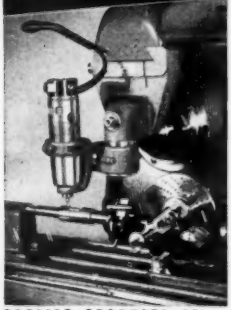
200. RUST PREVENTION along with barrel deburring is reported by use of Magnus Chemical Co.'s 26N

continued next page

For additional information Circle No. 68 on the Reader Service Card



LOWEST COST PRECISION
FOR TOOL ROOM AND PRODUCTION



ONE PORTABLE MULTI-PURPOSE PRECISE GRINDER-MILLER WITH MACHINE TOOL MOUNT DOES THE WORK OF A SINGLE-PURPOSE MACHINE COSTING 100 TIMES AS MUCH!

Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¼ HP, speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing; rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

*Write* FOR CATALOG

PRECISE PRODUCTS CO., 1342 Clark St., Racine, Wis.

PRECISE GRINDER-MILLERS



rust preventive compound as a barrel deburring material on small steel parts.

201. CONVEYORIZED DIPPING PROCESS that is automatically controlled has been announced by Apex Stamping Co. for quantity production of baked enamel and lacquer finishes on metal parts. Paint loss reported completely eliminated.

202. PORTABLE TOOL FOR BELT GRINDING is offered by The Carborundum Co. and Buckeye Tool Corp. who developed it jointly. Built of aluminum castings, it consists of idler pulley, supporting mechanism & contact wheel mounted on the tool spindle. Small size, serrated wheel is used.

203. LUCITE SALT SPRAY CABINET for fog-type spray testing of metals and coatings is available from Singleton Co. Said to be low-price unit.

204. POLISHING HEAD designed specifically for economical deburring of turbine disc-slots by Murray-Way Corp., is reported to be highly adaptable for other jobs. Multiple head, universal-positioning & compactness are features.

205. EXPANSION & IMPROVEMENT of their line of abrasive chips for Roto-Finish barrel finishing operations has been announced by Roto-Finish Corp. Chips are available for grinding, deburr-

That statement came from a manufacturer who cooperated in the field-testing of Oakite Composition No. 95. Here are some of the advantages he found in this new anodic conditioner:

**Brighter plating**—All films removed . . . no residues, no undersurface shadows, no anodic blackening, nothing to impair the brightness of the electroplate.

**Fewer rejects**—Major causes of peeling and blistering eliminated . . . consistent success in test-baking for 60 minutes at 300°F.

**FREE** For a copy of "*Good news about electrocleaning zinc-base die castings*"—describing the use of Oakite Composition No. 95—write to Oakite Products, Inc., 35 Rector St., New York 6, N. Y.

*Technical Service Representatives in Principal Cities of U. S. & Canada*

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

For additional information Circle No. 67 on the Reader Service Card

*Machine de-burring*
*with* **NOBUR**
*pays BIG production dividends!*

**NOBUR Tools** *turn a slow bench operation into fast and efficient machine work!* Remove burrs on multi-walled parts with a smooth, clean cutting action that won't mar highly finished surfaces. Eliminate rejects from slow, costly hand work with files, scrapers and abrasives.

**Nobur Tools** are used on any lathe, drill press, portable drill or flexible shaft. Operation of the double-edge cutting blade is easy and safe . . . no skilled help is required, and the spindle *never needs to be stopped* for either de-burring or chamfering.

**Nobur Tools** cut freely on either hard or soft metals, are simple in construction and are made in sizes to cover a full range of hole diameters. ***NEW "DS" SERIES extends range of NOBUR applications to holes as small as 1/8" diameter. WRITE FOR FULL DETAILS TODAY!**

NOBUR MANUFACTURING COMPANY
719 N. VICTORY BLVD., BURBANK, CALIF.

For additional information Circle No. 66 on the Reader Service Card

ing, descaling, polishing, britehoning & coloring ferrous or non-ferrous parts.

206. PORTABLE ELECTRIC OVEN for high temperature processing is offered by Grieve-Hendry Co. Thermostat control of Inconel sheathed tubular heating elements provides heating range of 300-1000F.

207. WATERPROOF SANDPAPER for industrial use has been introduced by Behr-Manning Corp. Called Tufback Speed-wet Durite Paper, it is said to maintain initial sharp "bite" necessary in wet sanding. Maximum flexibility & body strength reported.

208. ROTARY 12" TABLE made of sorbocast casting for greater strength has been introduced by Kenco Mfg. Co. Accuracy is guaranteed within .0005 in concentricity runout, and .001 in parallel from top to base.

209. INCREASED LIFE of cutting tools is reported by use of new wheel lapping method developed by Penn Scentific Products Co. Sharp, finish-lapped cutting edges obtained. Special Spectrum lapping wheels, and diamond lapping compound in any desired grit are used.

**LOW-PRICED BARREL FINISHING MACHINE**

*Model TMK*
*Rampe Manufacturing Co.*

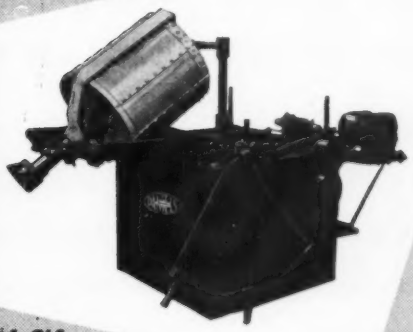
SPECIAL FEATURES: Low-priced, hexagonal steel burring barrel has been added to the company's line of Tumbler-Mixers. Sturdily constructed machine is designed for production finishing of small parts or small lots of large parts.

SPECIFICATIONS: Barrel has 200 lb. capacity, turned at 33 rpm by a ¼ hp 110 v AC single phase motor. Anti-friction bearings throughout; automatic slack take-up to keep turntable belt tight; floor space — 36" x 19"; height 33"; weight 130 lbs. Barrels furnished unlined or lined with vinyl plastic which is resistant to oil & chemicals.

*For additional information circle No. 216 on Reader Service Card*


THE OLS FOR BETTER PLATING

Before you invest in barrel plating equipment, check the features of the Daniels OLS Plating Barrels. Forty years of experience in manufacturing barrel plating equipment have led to the new Daniels OLS which can only be fully appreciated by thoroughly reviewing the facts as illustrated in our new catalog. *Write for your copy today!*



#4 OLS in unloading position

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MANUFACTURERS and DISTRIBUTORS
Electroplating and Polishing Equipment and Supplies
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DANIELS

*For additional information Circle No. 41 on the Reader Service Card*

# REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

1. AUTOMATIC POURING of aluminum for cold chamber die casting is introduced by Ajax Engineering announcing new melting equipment.

6. DIE CASTING MACHINE catalog showing complete line of precision equipment is offered by Cast Master.

7. SMALL DIE CASTINGS produced by a specialized department of Dollin Corp. are subject of a booklet. Sample castings included.

9. DIE CASTING MACHINES produced by Kux are the subject of a catalog offered by that company.

12. HOW TO CUT finishing costs by use of Velvaglaze aluminum castings is subject of brochure from Monarch Aluminum.

13. ALUMINUM HEAT CONTENT chart & furnace specs. are offered by Stroman Furnace.

19. ALUMINUM ALLOY SELECTOR to aid in analysis of foundry problems is offered by U. S. Reduction.

21. SELF-TAPPING SCREWS and suggestions on how to use them are the subject of literature from Parker-Kalon.

22. FACILITIES FOR PRODUCING aluminum castings are introduced in a booklet from Acme Aluminum Alloys, showing their plant and equipment.

23. DIMENSIONING DIE CASTINGS is the subject of a guide book from Newton-New Haven Co.

26. IRIDITE FOR PROTECTING metal surfaces is described in literature from Allied Research.

27. SCREW THREAD INSERTS for use in die cast metals are the subject of a data sheet from Groov-Pin.

31. CENTRIFUGAL INVESTMENT castings produced by Electronicast are the subject of a folder telling about the process & its applications.

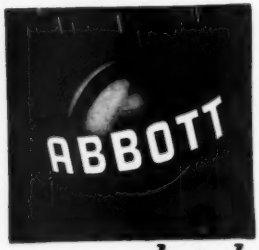
32. ZINC ALLOY SUPPLIERS, Henning Bros. & Smith, offer a monthly house organ called The Henning Messenger.

33. HOW TO DESIGN aluminum & magnesium die castings is the subject of a data book from Litemetal Dicast.

35. FACTS ABOUT PRESSED powder parts is subject of a comprehensive design booklet from New Jersey Zinc.

37. TOOLS FOR DIE WORK & a regrinding service are in the "All Star" catalog from Severance Tool Industries.

39. PLASTER MOLD CASTING — what it is and what it offers the designer — is covered in illustrated brochure from Universal Castings.


*deep hardened and polished carbon steel*

**BURNISHING MATERIALS**

*for superior barrel finishing of*

**Military and Civilian parts and products**

Abbott barrel finishing experts are ready to help you solve your burnishing problems with five scientifically designed shapes which make effective contact on parts, stampings and castings of every size and shape.

***Write for details. No obligation.***

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1084 NEW BRITAIN AVE.
**Hartford 10, Conn. U.S.A.**

*For additional information Circle No. 85 on the Reader Service Card*

40. PRESSES FOR MOLDING plastic patterns for investment castings are described & illustrated in catalog from Van Dorn.

41. PLATING BARRELS for low cost electroplating are presented in literature from Daniels Plating Barrel.

42. DRYING SMALL METAL parts with specially-designed driers is the subject of brochure from New Holland Machine Co.

43. DIE CASTINGS FOR DEFENSE is the subject of a booket, "We're Geared for Your Defense Needs," from Advance Tool & Die Casting.

44. METAL-OF-THE-MONTH is a monthly resume of metal market news & data from Belmont Smelting.

45. ALLOYS FOR INVESTMENT casting are described in literature available from Cannon-Muskegon.

48. SMALL DIE CASTINGS — review of size, alloy & design limits in folder from Gries Reproducer.

50. DESIGNING FOR POWDER metallurgy is subject of handbook from International Powder Metallurgy.

55. CHROME-LIKE BRILLIANCE and methods for applying it to zinc surfaces are reported in literature from Chemical Corp. describing their Luster-On dip.

56. LONGER LIFE FOR DIES is reported in bulletin from Pangborn Corp. describing Hydro-Finish process for wet blasting die casting die surfaces.

59. GUIDE TO INVESTMENT casting is contained in booklet from Investment Casting Co. Advantages & applications are included.

60. IMPREGNATION OF CASTINGS to seal porosity is covered in brochure on Mogullizer impregnation equipment from Metallizing Co. of America.

61. SHELL MOLD CASTING facilities newly opened by Die Mold Casting Div. of P. M. P. are the subject of literature.

62. REFERENCE FOLDER on a line of P-V investments for the investment casting process is offered by Pre-Vest.

63. HOW TO HEAT WAX for making investment casting patterns is the subject of a booklet from Sta-Warm Electric Co.

65. BARREL BURNISHING of small parts is thoroughly presented in a manual from Abbott Ball.

66. DEBURRING OF HOLES by means of a new type of tool is the subject of a folder from NoBur.

67. ELECTROCLEANING ZINC die castings is subject of new booklet from Oakite.

68. MULTIPURPOSE GRINDER & MILLER unit is described in illustrated literature from Precise Products.

73. FILLING ENAMEL in recessed designs or lettering is described in literature from Acromark.

74. BARREL FINISHING is discussed in 3 booklets from Almco Div., Queen Stove Works, covering process, materials & equipment.

"Take it with a grain of salt"..
We're all inclined to boast about the quality and superiority of our products. And those who hear or read our claims, naturally discount them accordingly. That's why we at Badger prefer to let the records speak for us—records which show that many leading manufacturers of household utensils have had Badger die cast their products for over 33 years.
Consult Badger on all your die casting problems.
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# Let this 32-page manual

FREE

# help you decide

## where you can save with parts made by powder metallurgy

There's no need to hunt far and wide for the information you want on structural parts made from nonferrous powders. Make use of the concise design and engineering data in "FACTS ABOUT PRESSED BRASS and other nonferrous POWDER PARTS."

It's brand new. It's authoritative and unbiased (The New Jersey Zinc Company makes metal powders but not powder metal parts). It covers such topics as

| | see pages |
|---|---|
| Maximum and minimum sizes | 3–5 |
| Practical shapes | 5–8 |
| Physical and mechanical properties | 9–10 |
| Precision and tolerances | 10–11 |
| Plating and other finishes | 11–12 |
| Self-lubrication | 12–13 |
| Production speeds | 13–14 |
| Raw material and tool costs | 14 |

*. . . plus 26 case histories . . . plus a listing of definitions and standards used in powder metallurgy . . . plus a picture sequence of how sinterings (powder metal parts) are made.*

**Send for your copy now. Use the coupon.**

THE NEW JERSEY ZINC CO.
160 Front St., New York 38, N. Y.

Send a copy of "FACTS ABOUT PRESSED BRASS POWDER PARTS"

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CITY_____ ZONE____ STATE_____

POSITION_____

M

*For additional information Circle No. 35 on the Reader Service Card*


### SIPI METALS NAMES NEW SALES MANAGER

New general sales manager for Sipi Metals Corp., Chicago non-ferrous smelters, will be Maury E. Lippert, it has been announced. Mr. Lippert has been with the company for 14 years and has been active in metal sales for 33 years. He is well known in the die casting industry.

### LINDBERG GOES WEST

Lindberg Engineering Co., 2410 W. Hubbard St., Chicago 12, Ill., manufactures of industrial heat treating furnaces and supplies, has purchased 4½ acres of land adjoining the Southern Pacific Railroad tracks in Los Angeles, Calif.

The Comany plans the building of a plant and offices for the manufacture of all types of Lindberg heat treating and Lindberg-Fisher melting furnaces as soon as possible.

WEAK ASSEMBLY REPLACED
continued from page 23

design of the tip to give better oil flow characteristics, reduced danger of leakage and failure of the riveted joint, and decreased the load on the screw machines, punch presses, deburring equipment and assembly departments.

This same line of thought was followed in studying the female coupling piston. Again an inherently weak assembly could be replaced with a single casting having better flow characteristics and all of the other advantages noted in connection with the male coupling sleeve.

The two die castings which replaced the older assemblies are shown in Figure 2 These castings are furnished by the foundry, The Ace Die Casting Co. of Chicago, Ill., ready for installation in the coupling, thus removing all of the machine load. Other than a barrel deburring operation to give a smooth surface, the only machine operation performed on the castings is to cut the washer groove in the piston.

The reduction in manufacturing cost by shifting to die casting is, in this case, quite large. In the case of the piston, the cost was cut 88 percent while the sleeve cost was cut 92 percent. Savings of this magnitude are, admittedly, rather exceptional but quite large cost reductions are not at all unusual. It should be noted that the reduction in manufacturing cost is a direct saving and does not reflect the indirect savings realized from lowered machine loads, decreased inspection costs and improved customer satisfaction.

# PMM INDUSTRY NEWS

## NEW WAYS TO CAST MAGNESIUM TO BE DISCUSSED

A panel discussion on new developments in magnesium casting will be a feature of the 8th Annual meeting of The Magnesium Association at the Biltmore Hotel in New York November 10 and 11.

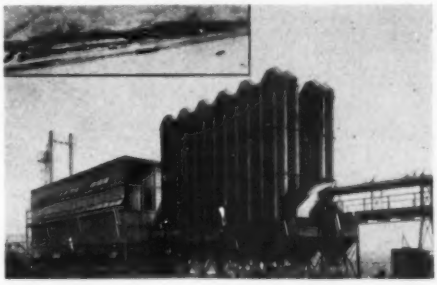
Investment casting and shell molding of magnesium will be among newer casting methods discussed in the panel to be chaired by H. E. Elliott of The Dow Chemical Co.

The two-day meetings will be open to the public, it has been announced by A. W. Winton, president of the Association. At luncheon meetings Monday and Tuesday, L. C. Mallet, assistant general manager, Pratt & Whitney Aircraft Corp., and C. A. Campbell, vice president and general counsel for Dow, will be speakers.

The session Monday morning held by the Casting Division, will feature a talk, "Grain Refining of Magnesium Alloys," by R. T. Wood of Aluminum Company of America, and a panel, "New Developments in Magnesium Casting." The latter will include "'Large Radar Sand Castings" by Elmer Lanfrancke of Rolle Mfg. Co.; "Investment Castings" by P. L. Butler of Arwood Precision Castings; "A Cast Aircraft Wing" by Ward Stewart of Alcoa; "Thin Walled Airframe Castings" by Ray Osbrink of Osbrink Mfg. Co.; and "Shell Mold Castings" by A. J. Marotta of Utica Radiator Corp.

Other technical and general discussions on magnesium production, service experience and testing procedures will occupy sessions Monday afternoon and Tuesday.

## LAVIN INSTALLS SMOKE CONTROL AT CHICAGO NON-FERROUS PLANT



In August R. Lavin & Sons, Inc., major producers of non-ferrous metals, completed an installation for the collection of zinc oxide fumes. By Extensive research by the company's engineering staff combined with data collected by men in the field inspecting other "smoke control" procedures, helped make possible the installation of this equipment.

This recent addition to the Chicago plant facilities continues the program of modernization commenced in 1946 with the establishment of similar equipment at the subsidiary North Chicago plant. The primary function of the "bag house" is to conserve zinc fumes in the form of oxide, which can be used extensively in industry.

## MAYTAG RESEARCH FACILITIES EXPANDED

As a part of a long range general expansion program of The Maytag Company, construction has been started on a new building which will double the facilities of Maytag's Research and Development Division at Newton, Ia. The building will stand north of the present Maytag research laboratory and will be similar in size and architecture to the one now in use. It will be ready for occupancy within six months.

From a staff of two men at the turn of the century, the Maytag Research and Development Division has been expanded to include 42 technicians headed by T. R. Smith, director since 1938.

## ADDRESSES FOUNDRY GROUP

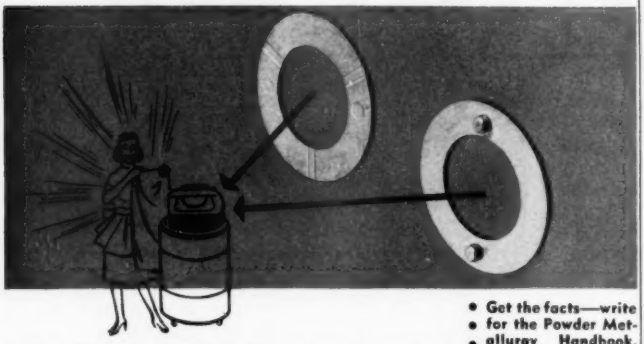
Donald L. LaVelle, research metallurgist of Federated Metals Division, American Smelting and Refining Co., addressed the Ohio Regional Foundry Conference on September 27th in Columbus, Ohio. The subject of his talk was "Aluminum Alloy Test Bars — Their Meaning and Production."

## GORDON OCCUPIES PLANT

The Claud S. Gordon Co., 3000 South Wallace St., Chicago 16, Ill., has announced the opening of its new manufacturing plant on a 6½-acre site at Richmond, Ill. Modern machinery has been installed for the manufacture of thermocouples, pyrometer accessories, speciality in-

For additional information Circle No. 50 on the Reader Service Card

. . . For smoother more efficient power delivery



Powdered Metal Thrust Bearings precision made in bronze and impregnated with lubricant, smoothly transmit force and motion from motor to wringer rolls. Check those cost saving advantages of components made by International Powder Metallurgy Co.

- controlled porosity — permits lubricant impregnation.
- close tolerances — no finishing operations required.
- cuts material loss — machining eliminated.
- lower costs.

- Get the facts—write for the Powder Metallurgy Handbook.
- Send for a copy on your company's letterhead.

IPM

International Powder Metallurgy Co.

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This Booklet Explains Why We Merit Consideration For Your Defense DIE CASTINGS

we're geared for your defense needs

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For additional information Circle No. 43 on the Reader Service Card

struments, and metallurgical testing machines.

The new facilities include also a modern complete insulating mill for applying insulation to all types of thermocouple wire and extension lead wire to meet standard and special order requirements. The home office and the headquarters for the engineering and service departments will remain at the Chicago plant.

---

**METALSMITHS NAME REPS**

Precision Metalsmiths, Inc., of Cleveland, manufacturer of investment castings, announces the appointment of The Crandall Co. to its field sales organizations. Crandall Co. representatives and there respective territories affected by the sales expansion include: Willard Crandall of Dayton, O.; Harry Edwards of Milford, O., a Cincinnati suburb, and Howard A. Meanor of Indianapolis.

De Cardy BROS.

specialists in small Die-cast Parts

45 YEARS of engineering skill and experience in the mass production of quality small zinc and lead base castings.

*inquiries invited*

send specifications or blueprints for quotation.

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Circle No. 69 on the Reader Service Card

# MPA RELEASES NEW ELECTRONIC CORE DATA

Users of electronic cores have long faced a confusing and time-consuming problem: the correlation of core manufacturers' designations with the basic materials used in their manufacture.

This situation has been virtually eliminated through the publication of a Data Sheet prepared by the Electronic Core Standards Subcommittee of the Metal Powder Association. Designated "M.P.A. Data Sheet No. 1, Revised," the sheet cross-references designations of the basic electronic core materials with the corresponding designations of the leading core manufacturers.

It is now possible to determine at a glance who makes cores from any of 42 different basic materials, what their core designation is, and what corresponding designations are used by other core makers.

The Data Sheet which was first issued in June of 1951 covered, at that time, 25 basic materials. The sheet has been fully revised and now includes 17 new materials as well as changes that had taken place in designations used by the core manufacturers.

M.P.A. Data Sheet No. 1 is available free of charge to all interested parties. Copies may be obtained by writing to the Metal Powder Association, 420 Lexington Avenue, New York 17, New York.

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### NATIONAL PRECISION CASTING NAMES SALES STAFF

Lester Chaundy, Sr., president of National Precision Casting Company of Clifton Heights, Pa., has announced the appointment of John F. Orsi as sales manager for the company.

Also appointed are the following sales representatives. George R. Wellmon, New York State; Robert McC. Maxwell, Western Pennsylvania, Eastern Ohio and West Virginia; William P. Hall, Western Ohio, Indiana and Lousville, Ky.

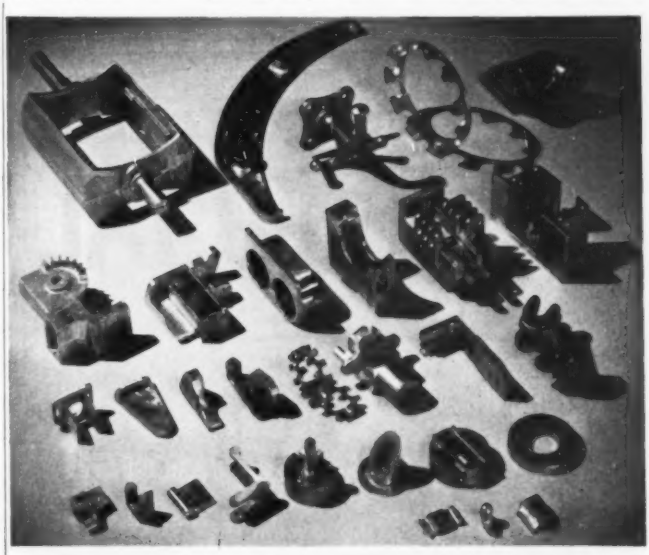
Also, Edmond Ward, metropolitan New York and Northern New Jersey; Joseph M. Ryan, Maryland, Delaware and Eastern Pennsylvania; Thomas McKeown, Long Island.

### HODGSON JOINS REX OIL

The Rex Oil and Chemical Company, 9120 Loren Ave., Cleveland 5, Ohio, announces that Don E. Hodgson has been appointed secretary of the company.

Hodgson, who will have complete charge of plant and office operations has a wide background in the petroleum and maintenance chemical fields.

For the past 3½ years, he

SMOOTH SURFACE FINISH

Precision Castings by Universal

All of the varied castings shown above have certain things in common:

- They are very accurate.
- They have smooth surfaces, inside and out.
- They are metallurgically sound all the way through.
- They represent genuine savings.
- They have all been produced commercially by Universal Castings Corporation.

Some other things you will want to know about these pieces, cast in plaster molds, are:

- They have been cast in a wide range of alloys, high strength manganese bronze, aluminum bronze, nickel silver, brass and aluminum.
- They can be produced economically in any quantity, large or small.
- They do not require high tool costs.
- They will fit into your production line, no matter what type of product you manufacture.

*Write today for your free copy of illustrated brochure — P-152.*

UNIVERSAL CASTINGS CORP.

5821 W. 66th Street • Chicago 38, Illinois

*For additional information Circle No. 38 on the Reader Service Card*

has headed the sales department of the Pennsylvania Refining Company. Prior to that time he was associated with The Warren Refining & Chemical Company for eight years, serving as purchasing agent and assistant sales manager.

**L. R. BRANTING RETIRES**

Luther R. Branting, works manager of Alcoa Mining Company's Bauxite, Ark., operations, has retired after more than 32 years active service.

PERMANENT MOLD ZINC

continued from page 32

to position and hold the three horns. The inner horn fits into the bore of the base casting and is cemented in place. The propeller casting is pressed into the mouth of the horn and the second inside horn fastened to it with a machine screw as shown. The outside horn bolts to the base casting using specially designed Speed-Nut assemblies as fasteners. These Speed-Nut assemblies consist of two nuts applied to a shaped steel strip. One nut acts to hold the outer horn to the base casting while the other one anchors to the skirt of the inner horn. This assembly provides all of the necessary rigidty and holds the three horn units in permanent alignment to each other and to the base casting.

Alignment of the horns with the base casting is essential since the driver unit containing the voice coil, magnet and diaphragm is attached to this same base casting. Any mis-alignment would, of course, cause distortion in the sound reproduction.

In the driver unit, there is another permanent mold casting. Here strength and maintenance of alignment are again paramount. Not only must these conditions be met, but the inner surface of this unit must be smooth to avoid distortion and power loss. Permanent mold castings fulfill all of these requirements.

On the driver unit casting, there is some machine work. Four holes must be drilled and counterbored, two holes drilled and tapped, one inside boring operation performed to give precision of fit not possible in casting, and the outside thread cut to allow the driver unit to fasten to the base casting. All of these machining operations are done in only 4½ minutes machine time, including setup. While no comparative figures are available, it is at once apparent that the machining time is only a small fraction of the time required to machine a sand casting if it were to be used.

The one other permanent mold casting used is the mounting bracket. This casting is used as received from the foundry with no machine work at all being required.


UNIVERSAL
Die Castings

*Preferred* WHEN ONLY THE BEST IS GOOD ENOUGH

There must be a reason why so many highly discriminating manufacturers entrust *all* of their work to us. The reason is they *know* from experience that the finished job will meet every specification as to appearance, strength, accuracy and function. Furthermore, the price on either long or short runs is in line with their production and selling costs.

If you are located west of the Mississippi River we are in an excellent position to take care of your die casting requirements. Quotations made promptly.

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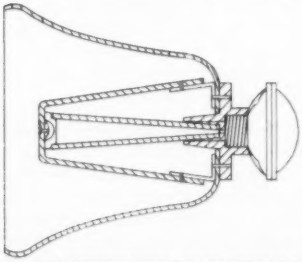
It was pointed out above that the castings used in this speaker were designed with two ideas in mind. The first detailed above was strength and alignment. The second idea influencing design was that at such time as production warranted, conversion to die casting could be made without any design changes. This factor has been kept in mind at all times. As the speaker is designed now, either permanent mold castings or die castings can be used interchangeably with no difference in cost other than the difference in the cost of the basic castings.



**3. CONSTRUCTION OF HORN is illustrated by this drawing. Note that inner horn is cemented into bore of base casting, and outer horn is attached with special Speed Nut.**

Even the finishing operations used are such that the same process and the same equipment can be used.

All of the zinc castings are given a Unichrome No. 95 treatment prior to spray painting. This treatment is:

1. Alkaline dip to clean and degrease.
2. Cold water rinse.
3. Phosphoric acid dip.
4. Chromic acid dip (15 seconds).
5. Hot water rinse.

Following this treatment, all surfaces that are to be exposed to the weather are given a lacquer spray that is baked for 12 minutes at 330 F. It has been found that this treatment gives a good serviceable finish. Those parts that are not exposed to the weather have, of course, the Unichrome finish which serves as adequate protection against atmospheric corrosion even along the sea coast.

DRILL PRESS
continued from page 33

distortion. As can be seen, half of each plug is recessed to receive a hexagonal nut, ½ inch bolt size in two cases and 5/16 inch bolt size in the smallest plug. These recesses are held so that the normal varations in the size of the nuts will be accommodated and still fit closely enough to prevent turning within the recess.

The tapered flats formed on each half of the plug bear against the drill press column in two cases and against the quill in the third case. It is in this application that the peculiar properties of a zinc die casting are valuable. If a harder material were used, there would be considerable danger of marring the quill or column when the bolt was tightened enough to pre-

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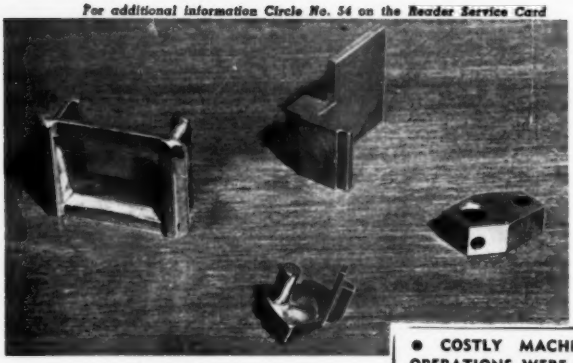

Scale: 2 to 1

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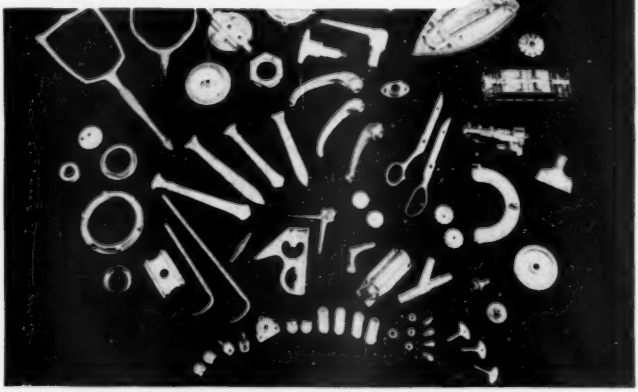

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**Die Castings are Used in a Drill Press**

continued from page 59

vent movement. Further, since the steel is nearly always coated with oil, a material with a relatively high coefficient of friction against the oily steel is required. A further requirement is that the deformation of the plug, when the bolt is tightened, should be elastic so that no permanent set is taken. All of these requirements are competently met by the zinc die castings.

The return spring housing shown in Figure 2 is a case where a die casting is subject to considerable stress, a condition which, if not accommodated might interfere with the service life of the tool. This housing contains the spring which returns the drill press quill to its uppermost position when the hand feed is released. Under this service, the casting is continually loaded and the load increases as the quill is lowered.

Wear is not a particular factor in this case since adequate clearance between the bore of the housing and the shaft can be provided so that tension adjustment can be readily made. The concentricity between the bore and the OD of the teeth is held to 0.0025 total indicator reading.

Since the locking groove must be machined after casting, it is more economical to allow the foundry some latitude in the OD of the teeth and to cut the groove and machine in tooth diameter as a single secondary operation using a form tool.

The return spring housing cover appears to be quite a simple casting. However, since it must be a snap fit onto the housing, slight interference between the cover and housing must be provided. Four small bosses are cast on the part of the cover which enters the housing and, to secure the desired

interference, the die was modified during initial casting operations until the quality of fit desired was obtained. Since this first modification, the die has remained stable enough so that neither undue tightness or looseness is experienced.

As a final finishing operation, the housing and its cover are chromium plated.

AIRCRAFT STRUCTURAL
continued from page 36

and melting furnace size. Thus, there are some features of QQ-S-618b, particularly physical property requirements, which cannot be met by investment casting.

It is generally known that as far as response to annealing and heat treatment, hardness, ultimate and yield strengths are concerned, there is very little difference between investment casting and wrought steel of the same compositions. In ductility, however, as measured by elongaton, reduction of area or impact, there is a considerable difference between investment castings and wrought steel in most grades. This is an important factor that the designer must take into account. Very often, having no casting specifications to refer to, designers have come up with specifications for wrought steels to which investment casting producers take exceptions immediately.

Investment castings are generally too small in section or size to permit machining of a large enough test specimen for tensile testing. Where the castings are of sufficient size to allow a tensile test of a piece cut out of the casting, the values of that test usually would not be truly indicative of the strength of the casting. The center portion of a heavy cast section is the weakest structurally and a tensile test taken from that area would result in valucs that would be lower than if the entire cross-section were tested. The "skin effect" adds considerably to physical properties of castings on most steel grades.

The accepted method of measuring mechanical properties of investment castings is the employment of cast .250 diameter tensile test coupons poured from the same heat or series of heats as the castings they represent. These test coupons are annealed, normalized or heat treated with the heat lot of castings they represent so both test coupons and the castings are given precisely the same treatment. Investment castings are seldom over ¼" in thickness or section and if the tensile test specimen is as sound metallurgically as the casting itself, it is reasonable to assume that the mechanical properties of both are very nearly identical.

A list of mechanical properties for a modified 4140 steel in-

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continued from page 61

vestment casting as determined by tensile tests of standard ¼" diameter test specimens for various tensile ranges is shown in Table 1.

As said before, very often the designer, not having an investment casting specification for the particular steel grade or mechanical properties for the part he is designing, will find a wrought steel specification and make this specification govern the material selected for the investment. More often a part originally designed to be made from a steel forging or machined from bar stock with appropriate wrought steel specifications noted on the drawing is referred to an investment casting maker for the purpose of determining whether the part can be produced at a lower cost.

In either case the investment caster will take exception to the

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wrought steel specifications. It is important to remember that *the tensile test properties attainable in investment castings are not equal to those in wrought* form in the same steel grade. Table II, a listing of actual test results of cast tensile specimens and how they compare with wrought specifications and investment casting specifications at three tensile levels, illustrates this point.

It should be noted that the wrought steel figures for elongation and reduction are based on a history of tests made in the longitudinal direction of hot-rolled bars and do not represent the transverse test properties, although actual parts may bear transverse loads.

It can be seen from the above that not one of the casting tests meets the wrought steel mechanical properties in reduction of area and only two tests in the 125,000 tensile range equalled or bettered the elongation re-


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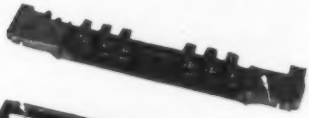

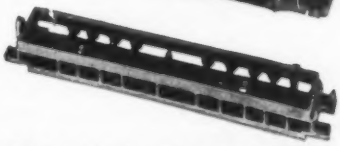

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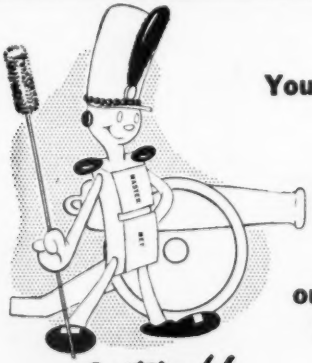

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**Aircraft Structural Investment Castings**

continued from page 63

quirements. Compared with Republic's investment casting specifications which were used in determining the size and sections in the design of certain aircraft structural parts, the castings pass the tensile tests by a comfortable margin.

After the aircraft engineer has successfully designed a part to be produced as an investment casting and an order is placed for the castings, it is necessary that inspection procedures be set up at both the casting foundry and the aircraft plant to assure the castings meeting the dimensional requirements, soundness, chemical analysis and mechanical properties

(Editor's Note: Part 2 of this article will be presented in the December issue of PMM. It will give a detailed case history of two investment castings used by Republic Aircraft, starting with original design and carrying them step-by-step through final inspection.)

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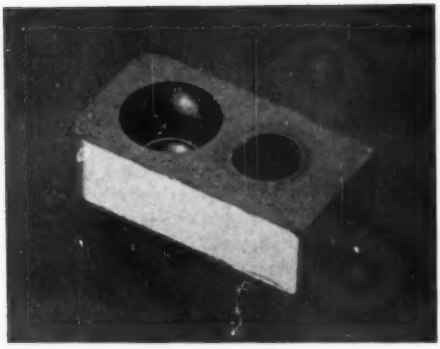
# *SIMPLIFIED SOLUTIONS*

## *for production problems*



REDUCING MANUFACTURING COSTS is one of the principal arguments for the use of sinterings. The nickel silver terminal clamp shown above is another example of how powder metallurgy pays off. Formerly made of brass bar stock and requiring six separate operations, including nickel plating to prevent discoloration, the terminal clamp is now made by pressing and sintering nickel silver powder. Dimensional accuracy is high and only one machine operation, that of tapping the 6-40 hole, is required. By the change in manufacturing method the cost of the clamps has been cut 84 percent.

FORMER METHOD

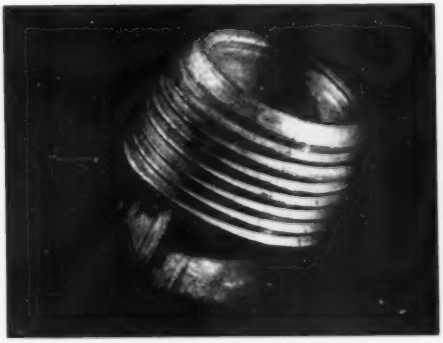
Fabricated from rectangular brass bar with the following operations:

1. Cut to 6" length,
2. Mill .281 dimension,
3. Mill 5/32" thickness,
4. Burr,
5. Drill and tap,
6. Nickel plate.

PRESENT METHOD

From nickel-silver powder in three steps:

1. Press powder into compact of final shape,
2. Sinter compact,
3. Tap 6-40 hole.



THE NUMBER OF INVESTMENT CASTINGS being used by military ordnance is steadily growing. One of the more recent additions to this group is the bronze index piece shown below. Manufactured by the Rode Co. of Woburn, Mass. for Army Ordnance, the part is used on the M-12 periscope.

This index piece carries tolerances that are within the commercial range of investment casting and it is, therefore, possible for the vendor to make this piece precisely to blue print specifications. Costs have been drastically cut through the use of investment casting as a manufacturing method and a superlative as-cast surface achieved. As delivered to the Army, this index is used with no further work being done on it.

CAST IRON, BRASS OR BRONZE are the traditional materials of construction for pipe plugs.

In those cases, however, where either weight or corrosion resistance are a factor aluminum is often used. Normally, these plugs are machined from either bar stock or from sand castings, with resultant high costs.

The pipe plug, at left, is die cast in aluminum by the Gem Die Casting Co. of Denver, Colo. It has all of the advantages of a fully machined or sand cast and machined plug at a fraction of the cost. As can be seen, even the threads are die cast so that the only finishing operation that is necessary is to trim the casting flash.

Thread contour, taper and size are held more nearly constant and to closer size tolerances by die casting than by other production methods so that assembly costs can be lowered. The plugs are adequately pressure tight and in many applications no "dope" is required. As contrasted with cast iron, these die cast aluminum plugs will never rust in to give a difficult removal problem.

## SIMPLIFIED SOLUTIONS -- Con't.

FUNCTIONAL DEMANDS, will in many cases, fix rigidly the design of a machine component. When this is the case the production department is faced with the problem of making the piece in the most economical manner strictly within blue-print specifications.

A part of this type is the spring core illustrated at left. Not only is the design set by functional requirements, but the end use of the machine, a bottle filler, requires a surface that is smooth, free of flaws, and that can be cleaned and sterilized easily. Obviously there are several methods of manufacture that could be used. Sand casting, followed by machining; machining from bar stock; investment casting and plaster mold casting are a few possible methods.

The choice is plaster mold casting and the alloy used in nickel bronze. As a finishing procedure the gates and risers are removed and the part tumble polished — that's all. As plaster mold cast, by Universal Castings Corp. of Chicago, Ill., the core rod meets all engineering requirements as to strength and size. As tumble polished, the requirements for a smooth, easily cleaned surface are met. Finally, as delivered to the user ready for installation in a machine, plaster mold casting is the most economical method of fabricating.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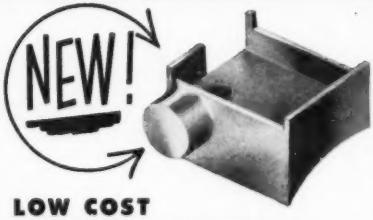


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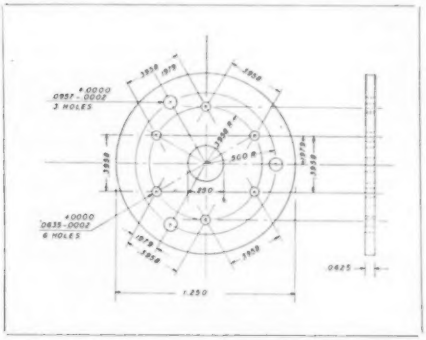
BEARING PLATE SINTERINGS

continued from page 27

for any fabricating process and exceptional for powder metallurgy.

In most cases where the dimensional accuracy approaches that of these pieces the parts are coined after sintering. These plates, however, are not coined. As molded from pure iron powder in a carbide die and sint-

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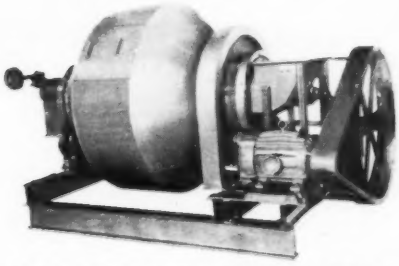

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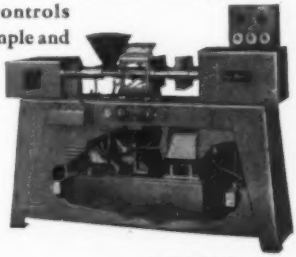

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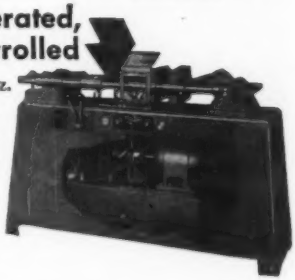

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The LITEMETAL BULLETIN

PLATING ALUMINUM DIE CASTINGS REQUIRES SPECIAL TECHNIQUES

Close Co-Operation Between The Die Caster And Plater Is Essential To Successfully Give Aluminum Die Castings Fine, Smooth Finishes

Commercial plating of the light metals is relatively new. As in the zinc die casting industry, aluminum die casters have had to virtually re-learn their art in order to produce castings of sufficiently high quality to provide flawless plated surfaces.

Litemetal has proved itself capable of producing plating quality castings, for the Kitchen-Quip Saladmaster (illustrated), in large quantities. Working closely with one of the most successful platers of aluminum, Litemetal has developed the high quality standards and specialized techniques necessary to make plating of this die cast product practical.

Because of its lightness and lower cost, die cast aluminum was chosen for the body, handle and legs of the Saladmaster. Virtual elimination of machining and consequent labor savings effected, plus reduced shipping costs, made this choice most practical. The product's required appearance was attained with chromium plate. Production rates now approach 1,000 sets per day and will increase greatly as soon as plating facilities can be expanded.

**Let's Talk It Over . . .**

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ered at 1800 to 2000 F the finished parts have a density of about 6.0 g/cc and are dimensionally correct. Prior to delivery, the sinterings are impregnated with oil so that the oil-wells mentioned above are no longer necessary.

Die costs for such a job as this are high, particularly since the core pins of high carbon high chromium steel wear rapidly and must be replaced frequently.

While not shown on the drawing, the bearing plates are subject to rigid inspection particularly as to flatness and to make sure that the cored holes are at right angles to the faces. Parallelism of the two faces is also important and is subject to inspection.

In spite of the high die costs, slow production due to the close tolerances required and the rigid inspection, the bearing plates are being produced at a substantially lower costs than the older brass plates they replace. An added advantage is the self lubricating feature secured through the use of a somewhat porous body.

### APEX SMELTING BUILDS PLANT

The Apex Smelting Co., of Chicago will start this winter constructing a new plant to produce aluminum from clay. Site of the plant will be Springfield, Ore. New process for producing aluminum from clay was developed jointly by Apex and the U. S. Bureau of Mines.

**PRODUCTION COST CUT 52%**
**by Investment Casting**

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*For estimates send sample parts or prints.*

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## NEW CANADIAN COMPANY FORMED BY ECLIPSE

A new company, Eclipse Fuel Engineering Co., of Canada, Ltd. has been formed to handle sales and service on "Eclipse" products in Canada, according to executives of the parent company, Eclipse Fuel Engineering Co. of Rockford, Ill.

The entire line of high pressure steam boilers, Dowtherm vaporizers, heat treating furnaces and containers, metal melting furnaces, forges, gas burners, centrifugal air blowers, gas boosters, gas-air automatic proportional mixers, control valves and gas distribution equipment, manufactured for over 40 years by the Rockford company, will be represented and serviced by the Canadian organization.

New offices for the company have been established at 705 Bloor Street, West, in Toronto. The office will be managed by Gordon E. Bouvier


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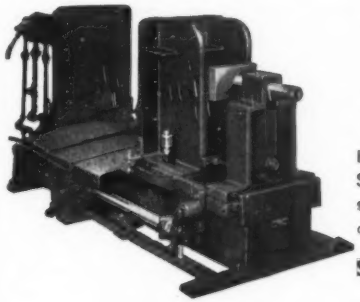

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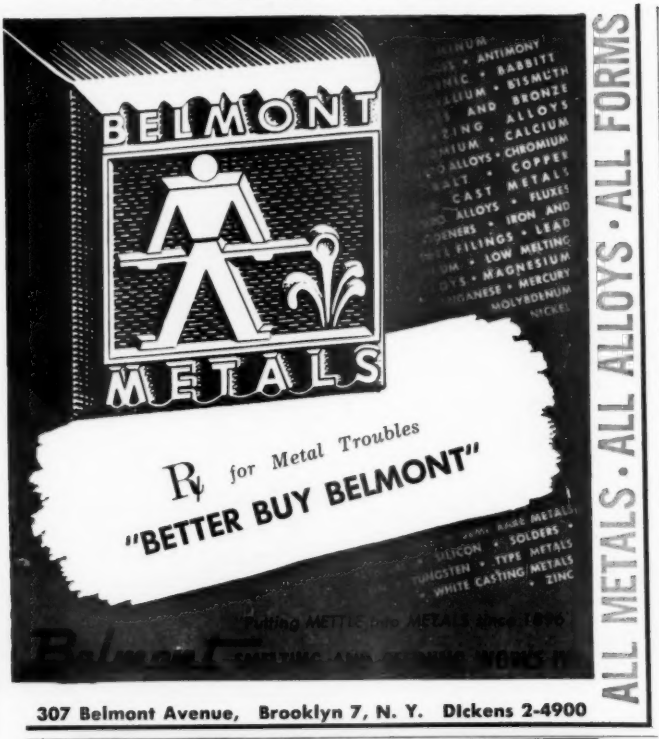


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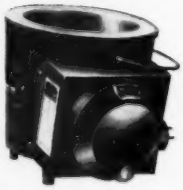

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